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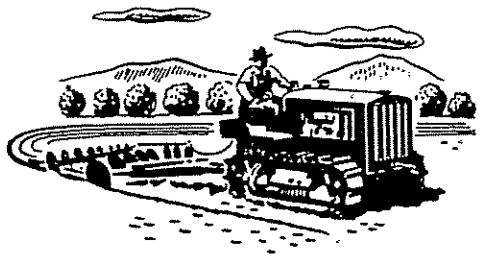
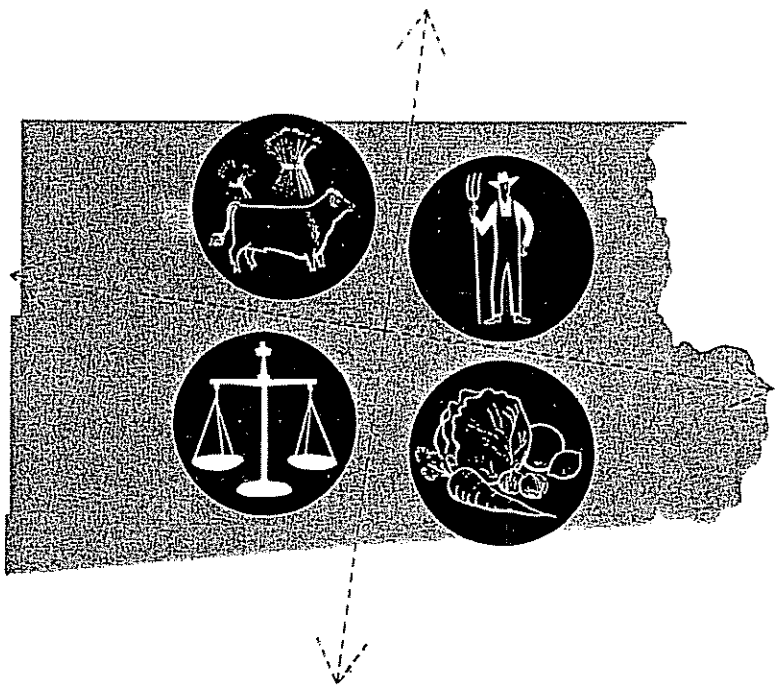


THE COLORADO RIVER
and
IMPERIAL VALLEY SOILS



A CHRONICLE OF IMPERIAL VALLEY'S CONTINUING FIGHT AGAINST SALT

EDITED AND PUBLISHED BY
IMPERIAL IRRIGATION DISTRICT

IMPERIAL PRINTERS EL CENTRO, CALIF.

FOREWORD

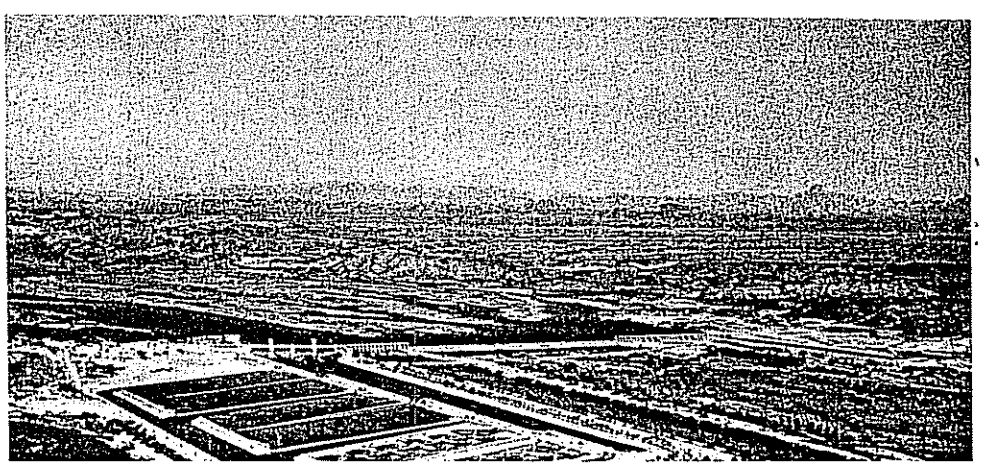
Elsewhere in the United States, soil conservation districts — formed as a result of referendum by landowners—are governed by an elected Board of Directors. In Imperial Valley, Imperial Irrigation District functions as the Soil Conservation District under an unique memorandum of agreement with the U.S. Department of Agriculture. Soil conservation policy is set by the District Board which also serves as a soil conservation board.

Soil scientists, engineers and conservationists provide technical assistance to farmers.

Soil engineering information and survey data, prepared by either the IID or SCS, are freely interchanged. The District provides clerical and office facilities for SCS, as well as public information assistance.

This booklet was prepared by the Community and Special Services Section of the IID in cooperation with Jack F. Smith, District Conservationist of the Soil Conservation Service.

Looking in a northeasterly direction, this aerial view of Imperial Dam shows the three desilting basins and the headworks. Note the empty basin in the foreground. The Colorado River is in the background.



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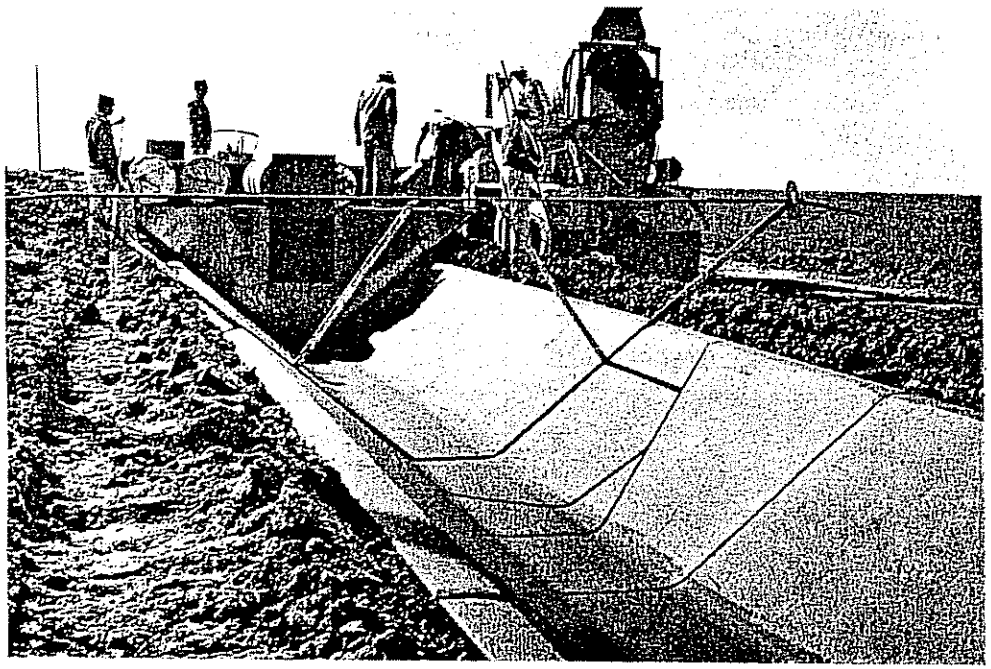
A. I. Boles, Chief Civil Engineer

U.S. SOIL CONSERVATION SERVICE

Jack F. Smith, District Conservationist



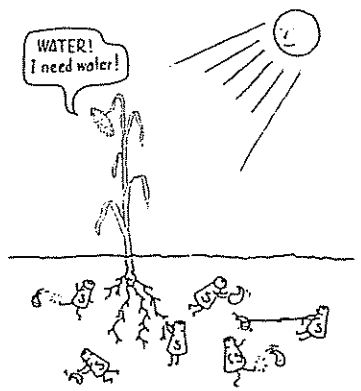
CONCRETE LINING

The District continues to wage a vigorous campaign for more concrete lining of laterals to provide a maximum amount of water for Imperial Valley fields.

During 1969, the concrete lining of earth section lateral canals, on a participation basis with the adjacent landowners, was continued, the landowners paying 25 per cent of the actual cost for placement of lining.

The District pays the remaining 75 per cent as well as the total cost of engineering, backfill and compaction of the old channel and applying joint sealant to contraction joints.

A total of 56.38 miles of these laterals was concrete lined in 1969 for the District's operation and maintenance, bringing the total since the beginning of the program to 453.21 miles.



Imperial Valley, the winter greenhouse of the nation, has been conquering the problems and obstacles that have tended to discourage farmers since 1901.

In 1900, this was a barren desert. With the construction of a heading on the Colorado River, 60 miles east of the Valley, irrigation water was brought into the thirsty desert in 1901. This successful diversion of water through a conveyance canal in Mexico was enjoyed for the brief period of only four years. A flood on the Colorado River washed out the control works and for about two years, 1905-07, the Colorado River flowed through the Alamo and New Rivers into the Imperial Valley, forming the Salton Sea.

At great expense, the Southern Pacific Railroad Company finally closed the gap on the Colorado River and new control works were installed. These were used to control irrigation water entering the Valley until 1942 when the All-American Canal was completed and Imperial Valley water was delivered via the new canal, with its entire length in the United States.

Salt and silt have been the downfall of many irrigated areas throughout the history of the world. Imperial Valley has been faced with both of these and has completely conquered the silt problem.

The salt problem is being fought vigorously and with good success. Yet, some difficulties continue to exist.

Colorado Poses Problems

Although it is a powerful and imposing river, the Colorado's flow is small. Its total length is about 1,400 miles and its bed covers 157 million acres of land, yet

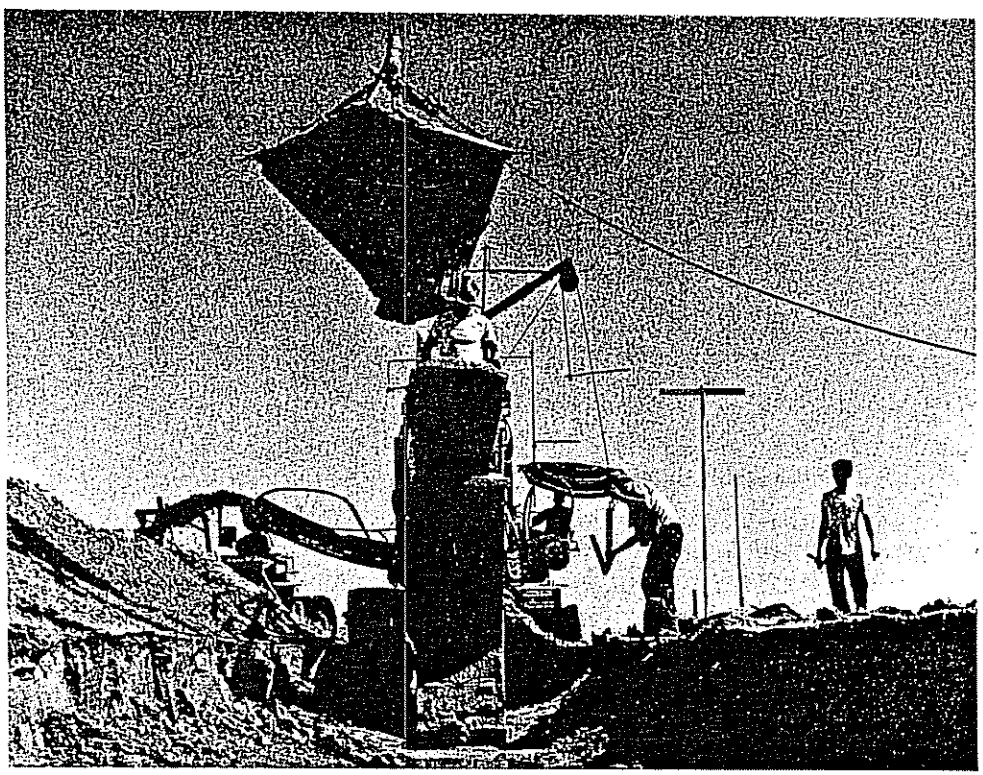
the river produces only about 14 million acre-feet of water per year.

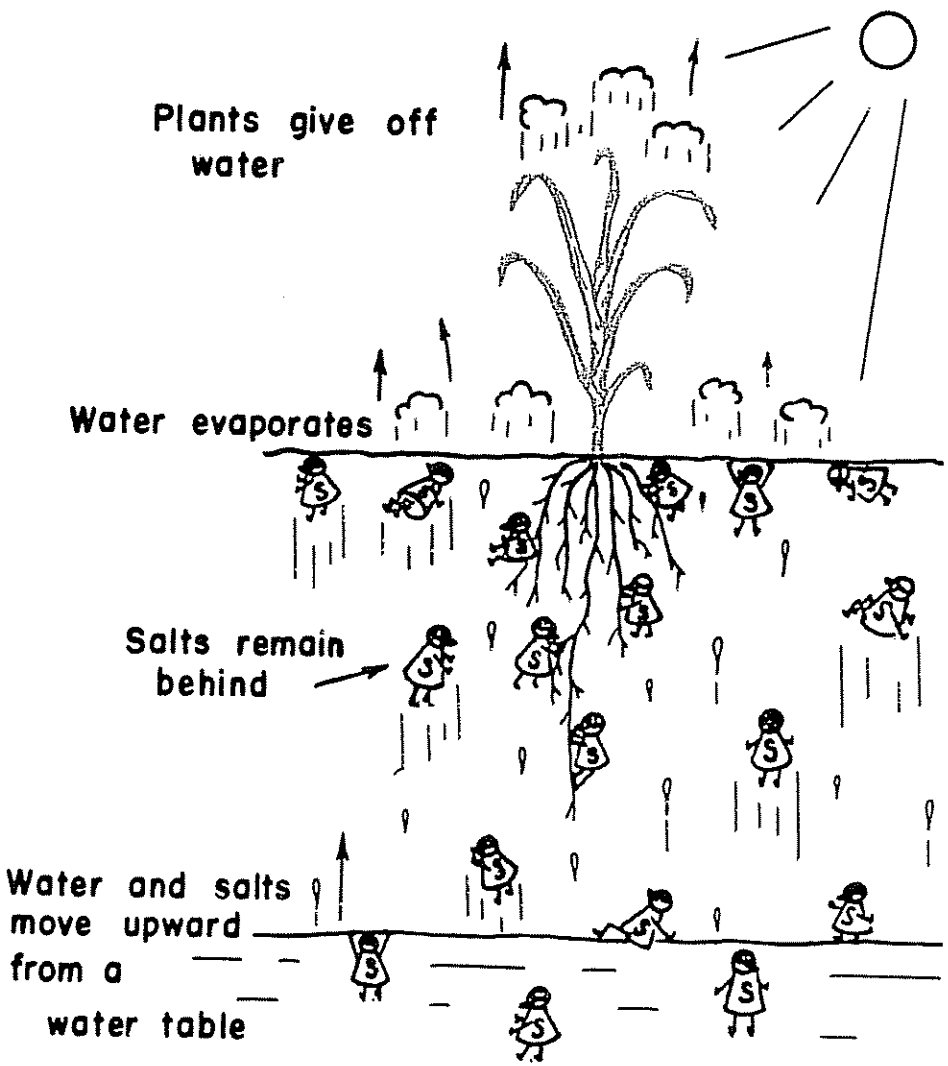
By comparison, the Columbia River, which is approximately the same length, has a flow of 184 million acre-feet.

Augmentation of the Colorado has been suggested as a remedy for two problems posed by its small flow: for one, it would produce the amount of water needed for agriculture in the basin states for many years to come.

It has been estimated that by the year 2020, agricul-

Drainage tiles have been laid under severe conditions — sandy soil with high water table. Within 24 to 48 hours, the water table can be made to recede with this operation.





appropriation of funds and construction of a reservoir from a water source may take another 30 years, making it 40 years before imported water will reach the Colorado.

The Imperial Irrigation District, therefore, has been pressing for a remedial measure which will relieve the problem somewhat — channelization of the Colorado River.

This would entail dredging the river to deepen the central channel. Phreatophytes, plants which consume an excessive amount of water, grow in abundance along the banks and in overflow areas of the river. Furthermore, the overflow areas contain an excessive amount of salts which are now being washed down the river.

Channelization would prevent this double threat. Some channelization work is now being conducted by the U.S. Bureau of Reclamation, but dredging of an important stretch of the river — in the Topock Gorge area — was stopped in 1968. The District hopes that it will soon be resumed.

In channelizing the river, the protection of fish and wildlife will be taken into consideration. This is shown by the work being done by the Bureau of Reclamation at Mittry Lake near Yuma, where an area of 325 acres has been set aside for waterfowl management purposes. Rough fish will be eradicated from the lake with subsequent planting of warm water game fish brood stock.

Salvaging of water, controlling scheduled water deliveries to Mexico and channelization should make close to one million acre-feet of water available on a short-range basis — not a final answer, but the only way in which the immediate threat can be removed.

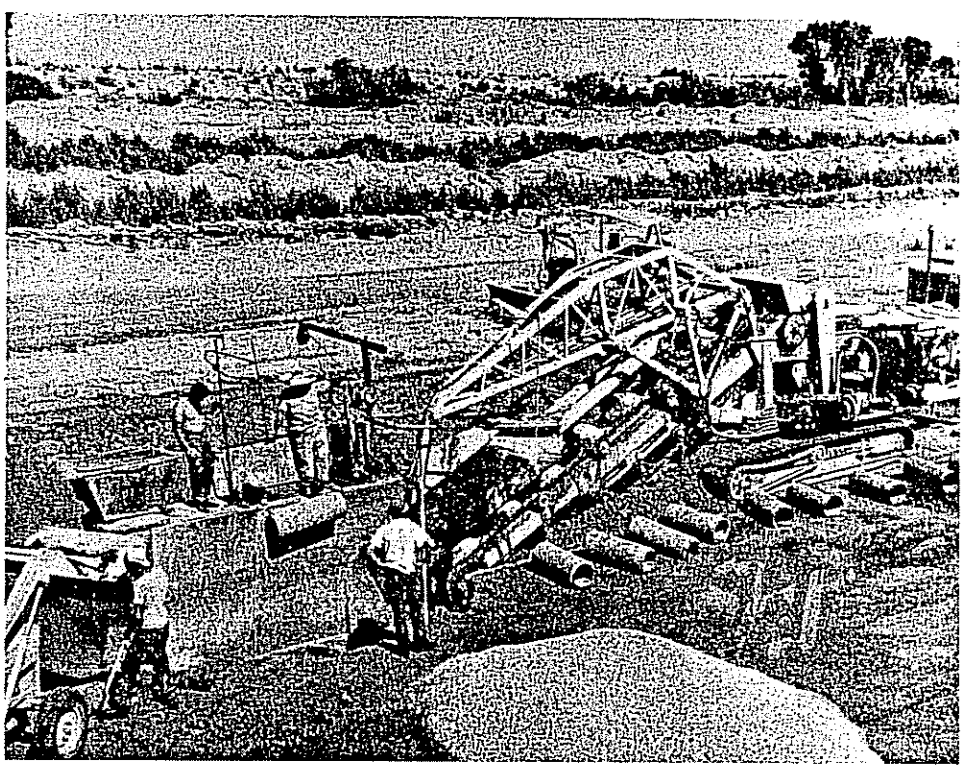
tural production in California will have to be doubled to take care of the estimated population.

The second reason for the need for augmentation is that it would reduce the salt problem. Increased flow would tend to dilute salt concentrations.

Over the years, the salinity of Colorado River water has been increasing. In 1953, it contained .94 tons of salt per acre-foot. Now, this amount has risen to 1.27 tons.

The Imperial Irrigation District has been vociferous in calling for studies to provide augmentation of the river. Long-range programs advocated include weather modification, desalinization of ocean water, or importation from another river such as, for instance, the Columbia.

Typical tiling operation in Imperial Valley shows installation of a base line. Sub-surface tiling increases the efficiency of drainage system, removes salt deposits.



But such solutions are many years away. In the meantime, the District has urged channelization of the river. This would provide a freer flow and drastically reduce phreatophytes, plants which consume large amounts of water.

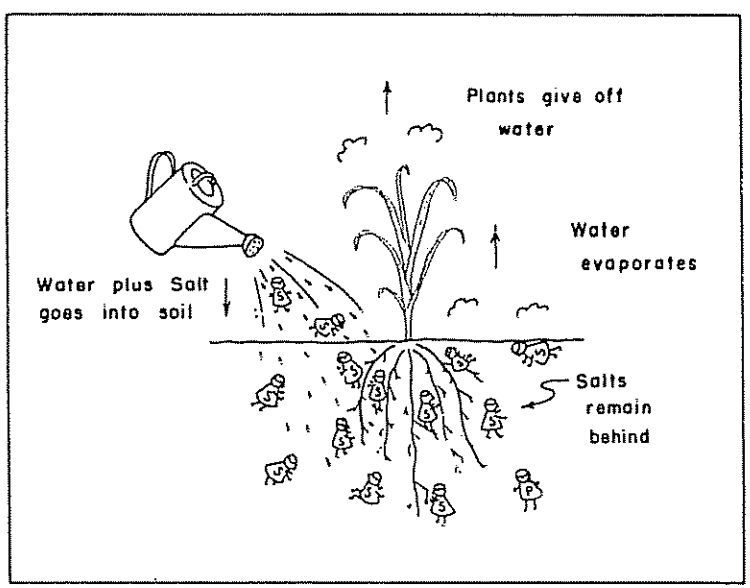
It would also prevent the river from overflowing into sloughs and other areas containing large amounts of concentrated salt deposits which are now being carried downstream and into Imperial Valley fields.

While this would not be a permanent solution, it would relieve the difficulties at least temporarily.

Nationwide Interest

The geologic background and the eventful and colorful period of development of Imperial Valley have attracted the interest of the whole nation and have offered a fertile field for writers of all types, both literary and scientific.

Perhaps the best known novel about Imperial Valley



beauty, it carries only a comparatively small amount of water. This has caused several problems, the solution of which has been compared to the challenge posed to the nation by its space program.

Deterioration of the water quality is rapidly becoming a major problem. Imperial Irrigation District General Manager Robert F. Carter has records which show that the quality of water coming into the IID system in 1953 averaged .94 tons per acre-foot of impurities at a minimum, while today the District uses water which averages 1.27 tons per acre-foot.

In 1968, the IID presented testimony before the Subcommittee on Irrigation and Reclamation of the House of Representatives Committee on Interior and Insular Affairs indicating that a further deterioration of water coming into the IID system will mean that a considerably greater quantity of water is needed by the District to do the same job it is doing now in washing salts and other impurities out of Valley soil.

Highest salinity level of the river during the year tends to occur during the germination period of the plants in winter, the time when plant seed is more susceptible to salt damage.

Various ways to remedy the situation have been suggested. There are three major long-range plans, and one immediate plan.

The long-range plans are to a) institute a program of weather modification (rain-making); b) to go ahead with construction of a giant desalinization plant; or c) import water from a different source.

Implementation of these plans is a long time away. Legal ramifications have delayed weather modification progress. A desalinization plant which would cost about $1 billion and which would be located somewhere on the Gulf of California is at least 30 years away.

As for importation, there is a 10-year moratorium on feasibility studies according to the Colorado River Basin Act of 1968. After that, it is estimated that studies,

Colorado River Water Entering Imperial Valley 1944 to 1969

Year	Discharge Below Drop No. 1 in Acre-Feet*	T.D.S.	P.P.M.	Total Tons Salt Imported via A.A.C.	Total Tons Salt Exported excl. Mexico**	Tons Gain (+) or Loss (—)
1944	2,445,002	0.96	706	2,342,420	2,102,938	—239,482
1945	2,515,586	1.01	742	2,544,585	2,332,480	—212,105
1946	2,697,450	1.00	735	2,701,835	2,288,977	—412,858
1947	2,633,390	1.02	750	2,685,445	2,321,893	—363,552
1948	2,699,314	0.98	720	2,655,204	2,542,314	—112,890
1949	2,761,992	0.93	684	2,564,129	2,709,346	+145,217
1950	2,938,666	0.94	691	2,749,108	2,855,378	+106,270
1951	3,066,618	1.00	735	3,056,565	3,139,970	+ 83,405
1952	3,203,411	0.95	698	3,043,417	3,364,335	+320,918
1953	3,353,244	0.98	720	3,273,515	3,684,315	+410,800
1954	3,095,783	1.01	742	3,132,052	3,648,649	+516,597
1955	2,927,165	1.17	860	3,419,238	3,577,562	+158,324
1956	2,906,746	1.27	934	3,682,548	3,713,208	+ 30,660
1957	2,781,792	1.22	897	3,399,439	3,603,489	+204,050
1958	2,730,876	1.00	735	2,723,153	3,341,376	+618,223
1959	2,840,173	1.00	735	2,852,019	3,401,652	+549,633
1960	2,983,860	1.06	779	3,162,485	3,558,534	+396,049
1961	2,957,200	1.13	831	3,330,087	3,572,808	+242,721
1962	2,951,266	1.15	845	3,399,464	3,806,946	+407,482
1963	2,991,429	1.13	831	3,378,583	4,050,087	+671,504
1964	2,770,474	1.19	875	3,284,284	3,635,121	+350,837
1965	2,624,363	1.30	956	3,406,457	3,819,255	+412,798
1966	2,817,912	1.30	956	3,650,447	4,148,874	+498,427
1967	2,719,861	1.22	897	3,306,261	4,139,477	+833,216
1968	2,806,124	1.21	890	3,408,548	4,012,009	+603,461
1969	2,675,833	1.27	934	3,396,105	3,754,477	+358,372

*The diversion at Drop 1 excludes any water delivered to Mexico.

**The tons of salt reported in the column entitled "Export" exclude contributions by Mexico.

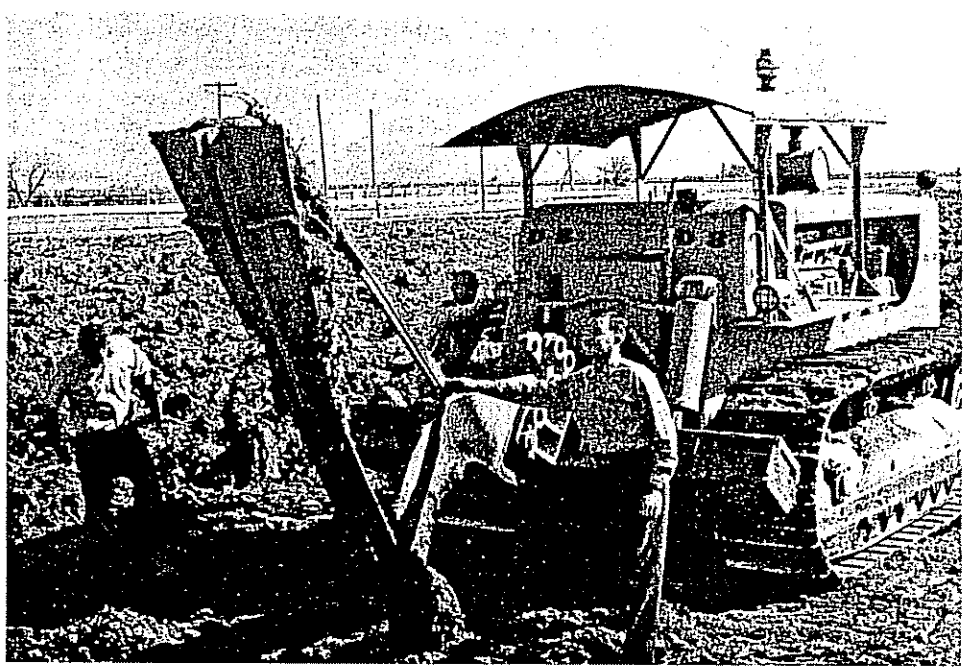
is "The Winning of Barbara Worth" — a best seller in its day — written in 1910 by Harold Bell Wright. The story is built around the river break of 1905-07 and the heroic and costly efforts to close the break and return the river to its channel to the Gulf of California.

Since then, many hundreds of books, magazine articles, scientific papers and newspaper stories about the Valley, or some of the major events in its history, have been published.

Throughout the years, the Valley has faced, and overcome, many a problem. Some of the stories that were published did severe damage to the financial credit of the Valley. Some of these stories were not based on fact, or gave a distorted picture of the facts.

There was, for instance, a story to the effect that the continued deposits of the large volume of Colorado River silt on its delta were so increasing the weight on that segment of the earth's crust that it would sink and

This slip plow is preparing the ground to allow deeper penetration of water.



permit the waters of the gulf to rush in and submerge Imperial Valley.

A highly distorted story about the Valley has recently been circulated by a usually reliable wire service according to which the salt situation has deteriorated to the point where thousands of acres have been abandoned. Imperial Valley's doom in the near future was forecast.

Nothing could be further from the truth. While the problem exists, the following pages will clearly point out that, despite large expenses, the difficulties are being overcome.

Silt Plagued Early Settlers

In the early days of the Valley, silt was a big problem in ditch maintenance because the water flowed from the uncontrolled Colorado River directly into the irrigation system. A Ruth dredge was invented locally to clean ditches without changing the depth. This was used until the Imperial Dam and the desilting control device were installed on the Colorado River in 1938. Since that time silt has been of minor consequence to the irrigation system.

The salt problem, because of its "build up," has not been an easy one to handle. It has involved the long-suffering and patience of many farmers. With the assistance of able engineers, soil scientists and soil conservationists they have been able to find satisfactory solutions to the problem.

The Valley is composed of recent deposits of water-transported soils. These have no "top soil" in the usual sense. Actually there is no soil profile. Instead, this Valley is a large 500,000-acre bowl filled with a conglomeration of soils transported here by the Colorado River. The soils are not the usual six to ten inches deep, but a full mile or more. Oil prospectors have drilled holes down as far as 12,000 feet before striking granite.

Hidden beneath the soil surface is a maze of passages of acquifers and aquicludes, of clay barriers and

The tenacity of the farmer in seeking a solution to the salt problem (because he realized that if the problem were created it should have a solution) has made him the envy of the farming industry of the world. The guidance and concern of the Imperial Irrigation District, with the assistance of the Soil Conservation Service, and in cooperation with other branches of the USDA, have helped him reach a high plateau of success.

Summing Up

The 1,400-mile-long Colorado River is the lifeline of Imperial Valley. Its water makes it possible to irrigate more than 500,000 acres in addition to serving some 78,000 acres on the Coachella Division and 67,000 acres on the Yuma Project in California and Arizona.

But while the river is powerful and fascinating in its

SALT TOLERANCE OF SOME CROPS

Up to 8-16* Millimhos	Only Up to 4-8 Millimhos	Not More Than 2-4 Millimhos
Barley	Rye	Field Beans
Beets	Wheat	Ladino Clover
Cotton	Sorghum	Radish
Bermuda Grass	Flax	Celery
Date	Alfalfa	Green Beans
Asparagus	Tomato	Orange
	Lettuce	Grapefruit
	Carrots	Lemon
	Grape	
	Cantaloupe	

*Electrical conductivity of saturation extract of the soil. The electrical conductivity is the reciprocal of the electrical resistivity. The resistivity is the resistance in ohms of a conductor which is 1 cm long and has a cross-sectional area of 1 cm^2. Hence, electrical conductivity is expressed in reciprocal ohms per centimeter, or mhos per centimeter.

December 31, 1955. While there was a gain in salts removed over the amount applied with irrigation water, there was considerable base exchange. The calcium and bicarbonates were tied up, releasing an excess of chlorides and sodium.

The percentage increase in saline content of the drainage effluent is more marked in the chlorides than the other salts. This is due to the greater solubility of the chlorides over other salts. The high sulfate content is due chiefly to native gypsum in the soil.

Valley farmers realize that saline soils require special crop management and treatment to achieve a good salt balance.

Even after a good reclamation job, the possibility of "salting out" still exists. Crop management practices which supplement leaching and tillage are: selecting salt tolerant crops, special irrigation practices and special planting and bedding methods for row crops.

Some areas are extremely difficult to balance, and on these Coastal Bermuda is recommended. This plant is salt tolerant and has a vigorous root system. It will open up the soils and aid in the mechanical leaching of salts out of the root zone.

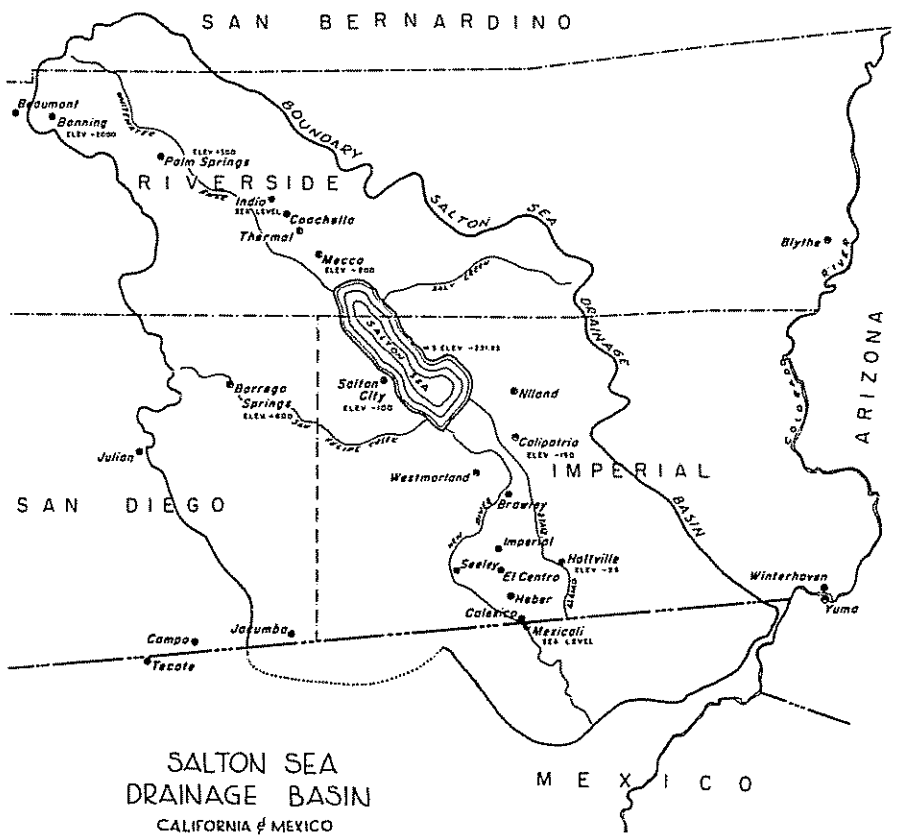
With the possibility of Colorado River water increasing in salt content, much study is yet needed to be sure some facet of the salt balance problem does not crop up and become a limiting factor.

The threat of water supplies being decreased causes a concern in which the reuse of used water should be explored. Some systems of pickup and reuse are being tried and will no doubt become more popular in the future.

Many successful farmers in the Valley can remember the time when the future was very dark. About 50,000 acres were out of production because of salt buildup and bankers were taking a dim view of making farm loans on land with so high a risk factor. This has changed. The land is now highly productive and much in demand.

land forms. In general, there is no gravel and sand water-bearing stratum. Stratum of any one type of soil does not extend over a large area, but occurs more as a lens or pocket.

Salt, being the main problem, has a way of accumulating in these layers of soil. It can accumulate in a layer of sandy soil in one area and travel through the sand to crop out some distance from where it entered. This causes an artesian pressure which often gives the farmers and technicians some real concern before it is discovered.



SOIL SALINITY AT PLANTING TIME
(MILLIMHOS)

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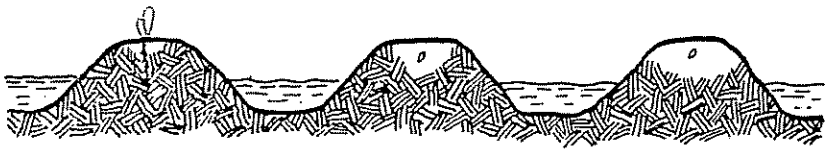
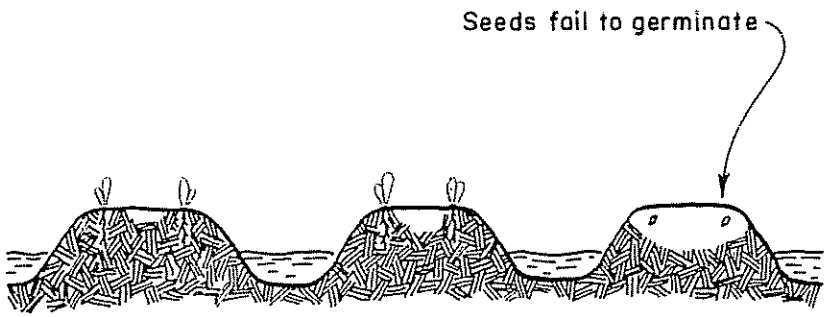
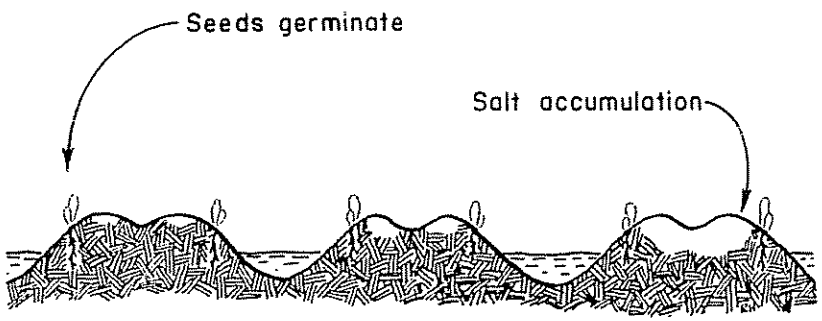


SINGLE ROW BED



DOUBLE ROW BED



SLOPING BED

water (see 1969 Salt Balance By Constituents, pages 14-15), there is sufficient calcium to keep the soluble-sodium-percentage less than 15, consequently adequate leaching can be acquired without soil amendments. But a good drainage system must be provided.

From this we can see that even though the amount of total soluble salts is appreciable, not all of these are detrimental, and that the quality of the gypsiferous water may be considered good. It is involved in bringing about a good salt balance.

The table on page 16 is a summary of the salt balance report over the 12-month period of January 1 to

REPORT — 1969

Adjusted Yearly Summary 1958-1969

Year	Tons of Salt Brought into the Area	Tons of Salt Removed	Per Cent Loss or Gain
1958	2,723,153	3,341,376	22.70% gain
1959	2,852,019	3,401,652	19.27% gain
1960	3,162,485	3,558,534	12.52% gain
1961	3,330,087	3,572,808	7.29% gain
1962	3,399,464	3,606,946	11.99% gain
1963	3,378,583	4,050,087	19.88% gain
1964	3,284,284	3,635,121	10.68% gain
1965	3,406,457	3,819,255	12.12% gain
1966	3,650,447	4,148,874	13.65% gain
1967	3,306,261	4,139,477	25.20% gain
1968	3,408,548	4,012,009	17.70% gain
1969	3,396,105	3,754,477	10.55% gain

Excluding Water and Salt from Mexico

of soils classed as saline are mainly determined by the type and amounts of salts present. The salts present control the osmotic pressure, which determines the amount of water that will be allowed to enter the roots.

Sodium seldom comprises more than half of the soluble cations and therefore is not absorbed to any significant extent. With the presence of excess salts, and the small amount of exchangeable sodium, the permeability is equal to or higher than similar nonsaline soils.

As noted from the analysis of the Colorado River

SALT BALANCE

Month	Summary Influent Total Monthly Discharge Ac.-Ft.	Summary Influent Tons of Salt	Summary Adjusted Effluent Total Monthly Discharge Ac.-Ft.	Summary Adjusted Effluent Tons of Salt
January	104,822	136,922	60,418	292,311
February	194,505	239,232	80,495	318,604
March	282,285	337,405	102,765	374,353
April	282,644	350,638	94,041	359,823
May	279,768	353,155	88,453	331,097
June	264,305	332,624	76,816	285,207
July	274,968	345,105	76,535	279,029
August	269,740	338,542	76,190	283,184
September	207,935	272,760	76,272	294,404
October	246,708	316,679	100,178	359,655
November	117,395	163,566	66,076	300,465
December	150,758	209,477	64,400	276,345
TOTALS	2,675,833	3,396,105	962,639	3,754,477

Apparent gain in Salt Removal = 358,372 tons or 10.55%.
Weighted Average Salt Concentration
Total Salt, Influent — 1.27 t.a.l., 933 p.p.m.
Total Salt, Effluent — 3.90 t.a.l., 2,867 p.p.m.
NOTE: p.p.m. = t.a.l. x 735

tem of drainage ditches which empty into the New and Alamo Rivers. Today, this system is approximately 1,400 miles long.

Farmers made private drain ditches on their land to help take away saline water; however, due to the fine texture of the soils the lateral movement of water was not great enough for these to be practical. In 1929 underground tile drainage systems were started. This practice became very popular, and today over 14,859 miles of tile have been installed.

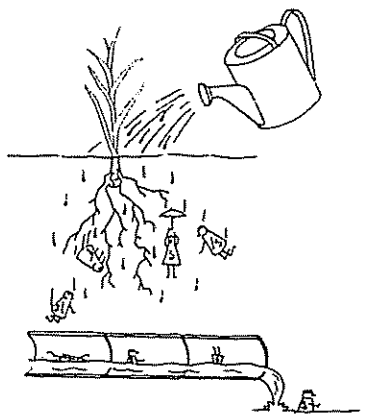
During the past 26 years, the Imperial Irrigation District has been calculating the amounts of salt into and out of the Valley once a week. This is accomplished by checking the salinity of the Colorado River water entering the Valley and that of the water entering Salton Sea via the New and Alamo Rivers.

This data represents a general trend, and even though more salts are leaving than entering, some areas are still getting into trouble with accumulated salts. These are usually areas that have inadequate drainage or are in need of improved tillage and agronomic practices.

SEA LEVEL
ELEVATIONS IN IMPERIAL AND
COACHELLA VALLEYS

	Feet
Crest of Imperial Dam	+181
Crest of Laguna Dam	+150
Colorado River at Andrade	+110
Summit of Pass North of Pilot Knob	+280
Mesa — Just West of Pilot Knob	+250
Mesa — Just West of Sand Hills	+150
East Highline Canal at Boundary	+ 40
Calexico	0
Westside Main Canal at Boundary	— 10
El Centro	— 45
Brawley	—110
Indio	— 10
Coachella	— 70
Mecca	—190
Salton Sea	—232

In the early days of the irrigation development, the Colorado River water averaged 1.0 ton of dissolved salts per acre-foot. About 1955 the salt content started to increase and in 1969 averaged 1.27 tons per acre-foot.



The water from most streams in the western United States contains salts in varying kinds and concentrations. They come from soils which have been exposed to water flowing to lower elevations. Under natural conditions the concentration of salt varies with the amount of water flowing.

Water Goes, Salt Stays

Concentration was low when the flow was high and vice versa. The increase in the over-all concentration is due to the evaporation losses from the storage reservoirs, such as Lake Mead, and the return of drainage water from irrigation projects. As the water evaporates, the salts remain.

With more irrigation development higher up on the reaches of the Colorado River, we can only guess as to what may happen to the salt content in the future. No doubt it will increase, adding to our problem of keeping salt moving through our soil.

With excess salt accumulation already in the soil and additional amounts arriving daily in "fresh" irrigation water, the problem must be solved in one of two ways: Either find additional sources of pure water, or increase the efficiency of the drainage system to transport greater amounts of dissolved salts.

Until 1949 the salt balance appeared unfavorable as more salt was entering than leaving the Valley. From 1949 on, there has been a complete change with

Until 1949 the salt balance appeared unfavorable. In that year 2,564,129 tons of salt entered the Valley and 2,709,346 tons were discharged into Salton Sea. From 1949, the picture has slowly improved with more salt entering the Salton Sea than is coming in via irrigation water from the All-American Canal. The tabulation "Salt Balance Report 1969," pages 16-17, shows the changes taking place.

At the end of 1969, 14,859 miles of tile drainage had been installed. A total of 994 miles was installed in 1964, a peak year. While this serves many acres, not all areas are adequately tiled. Because of the economics involved, many farmers will tile only the most severe areas, or complete only part of the system and then return to complete the job later. The Tile Installed table, page 12, shows Imperial Irrigation District figures on tile installed per annum.

In Imperial Valley the salt balance can be maintained by adequate leaching. Our calcareous soils come under the title "saline" because the electrical conductivity is usually greater than four millimhos per cubic cm and sodium-percentage is less than 15. Ordinarily the pH is less than 8.2.

Saline soils are often recognized by the white crust on the surface. Soil salinity may occur in soils having distinctly developed profiles or in stratified profiles as

BY CONSTITUENTS

TONS OF CONSTITUENTS					
HCO_3	SO_4	Cl	Total Cations	Total Anions	Total Tons
351,798	1,274,753	538,834	1,057,173	2,165,385	3,222,558
169,180	1,109,495	1,132,483	1,233,164	2,411,158	3,644,322
—182,618	—165,258	+593,649	+175,991	+245,773	+421,764
—51.91	—12.96	+110.17	+16.65	+11.35	+13.09

**Discharge at outlet has been adjusted by subtracting water inflow from Mexico from the metered outlet discharge. Tons of constituents has been adjusted by subtracting tons of constituents inflow from Mexico from the total tons of constituents outflow in Alamo and New Rivers at outlet computed prior to adjusting discharge for water inflow from Mexico.

crop. In general, sensitive crops will require about 25% more water than the plant needs, and more tolerant crops about 10%.

Salinity tests can be made to determine the amounts of leach water needed. The salinity level can be reduced about 80% with one foot of leach water for each foot of soil. For leaching to be effective, a good drainage system must be provided.

In 1940 the Imperial Irrigation District asked the Soil Conservation Service to conduct research on the drainage and salinity problems. From this work evolved the Donnan formula which is basic for the tile designs being made today.

Using this formula the designer must know the permeability, tile depth, drawdown, barrier location and drainage coefficient before tile spacing can be computed. Spacings in the Valley range from 50 feet in the silty clay soils to 400 feet in the sandy soils.

Most tile lines are installed at the 6-foot depth, because the Imperial Irrigation District will maintain an outlet at this depth for each 160-acre parcel of land. Some problems call for deep tile 8 to 12 feet. On these the farmer must maintain his own outlet, whether it be open drain or sump and pump.

SALT BALANCE

1969	Total Discharge A.F.**	Ca	Mg	Na+K
Influent	2,675,833	386,006	129,512	541,655
Effluent	962,639	279,952	141,518	811,694
Balance (Tons)		—106,054	+12,006	+270,039
% Gain or Loss*		—27.47	+9.27	+49.85

*Minus sign denotes loss. Plus sign denotes gain

Excluding Water and Salt from Mexico

more salt leaving the Valley and entering Salton Sea than is coming in via the Colorado River water.

The system for maintaining the salt balance in Imperial Valley consists of two main outfall branches—the New and Alamo Rivers — into which empty some 1,400 miles of open ditch drains, dug and maintained by the Imperial Irrigation District. These open drains serve as outlets for the tile drainage systems of the individual farms.

The salt removal then depends on a process called leaching and is accomplished by keeping the salts moving down through the soil by applying more water than the crop uses.

The excess water passes through the root zone, carrying away the dissolved salts. The percentage of applied water that must pass through the root zone depends on the salt content of the water, the salinity level to be maintained, and the salt tolerance of the

This field resembles a worn carpet due to salt accumulation.

TILE INSTALLED

1929 to 1969

Year	Mileage Tile Installed	Acreage Tiled
1929 to 1943	536.08	25,120
1944	60.00	1,880
1945	55.00	3,240
1946	133.25	5,480
1947	325.00	17,920
1948	393.80	17,220
1949	455.62	21,670
1950	458.00	22,610
1951	603.10	22,665
1952	709.54	23,345
1953	512.19	16,000
1954	491.12	14,960
1955	526.92	15,160
1956	519.36	13,290
1957	560.97	12,200
1958	490.88	10,690
1959	546.54	9,550
1960	794.05	15,713
1961	857.51	17,921
1962	611.01	11,485
1963	766.02	10,129
1964	993.97	12,707
1965	734.52	7,958
1966	527.38	6,634
1967	634.00	6,419
1968	754.33	6,046
1969	808.64	6,010
TOTALS	14,858.80	354,022

CONCRETE LINING OF LATERALS

1954 to 1969

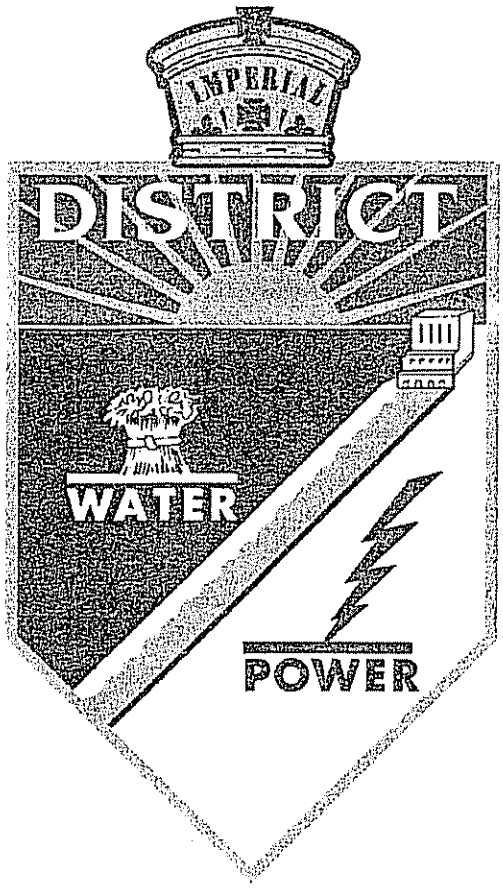
Year	Miles
1954	.50
1955	1.65
1956	4.91
1957	7.53
1958	6.72
1959	11.63
1960	8.22
1961	13.47
1962	19.10
1963	33.20
1964	53.04
1965	54.53
1966	68.99
1967	60.64
1968	52.70
1969	56.38
TOTAL	453.21

NET ACRES IRRIGATED

1944 to 1969

Year	Acres
1944	384,256
1945	393,699
1946	405,646
1947	412,083
1948	426,821
1949	428,925
1950	429,045
1951	434,648
1952	444,853
1953	445,061
1954	452,391
1955	474,557
1956	482,374
1957	494,234
1958	496,922
1959	440,293
1960	434,379
1961	435,664
1962	429,557
1963	430,481
1964	431,708
1965	432,612
1966	437,529
1967	445,428
1968	441,155
1969	442,294

20.80



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BY M. J. DOWD

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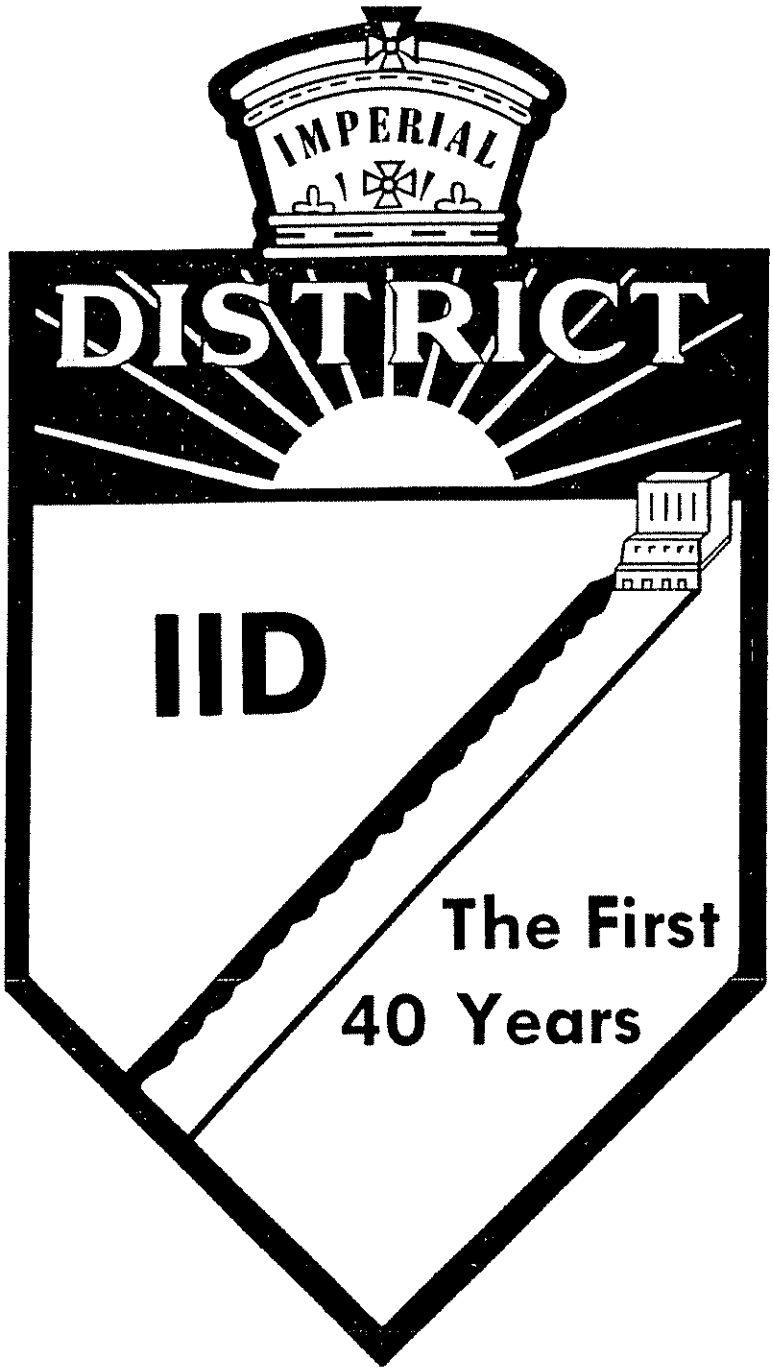

BY
M. J. DOWD

HISTORY OF IMPERIAL IRRIGATION DISTRICT

and the

DEVELOPMENT OF IMPERIAL VALLEY

by

M. J. Dowd
Executive Officer

1956

PREFACE

The following history of the Imperial Irrigation District was prepared by Mr. M. J. Dowd, who served the District from 1922 until his death in 1965, as Consulting Engineer and Executive Officer to the Board of Directors. The history covers the early years of the District until 1940. It was Mr. Dowd's intention to prepare additional chapters covering the All American Canal project, power development, the Salton Sea, and the period from 1940 to date. It is unfortunate that he was unable to complete that work.

Mr. Dowd's original manuscript prepared in 1956 contained a bibliography, and reference list which were not completed and therefore, are not included here. They are filed in the Imperial Irrigation District's Dowd Memorial Library located in El Centro.

Mr. Dowd labeled this manuscript a "Preliminary Draft", but no attempt has been made to make any changes other than minor editorial corrections.

Richard N. Taylor, Director
Community & Special Services

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HISTORY OF IMPERIAL IRRIGATION DISTRICT
and the
DEVELOPMENT OF IMPERIAL VALLEY

by

M. J. Dowd
Executive Officer

I. DESCRIPTION OF AREA

The Colorado Desert

In the extreme southeastern portion of the State of California, there is a large enclosed basin known as the Colorado Desert, with a drainage area of some 7,500 square miles. It extends from San Gorgonio Pass on the north, where the adjoining mountains reach elevations in excess of 10,000 feet, southeasterly some 200 miles through Coachella Valley, Imperial Valley, and the Mexicali Valley of Lower (Baja) California, Mexico, to the dividing ridge or median line of the Colorado River delta in Mexico. This broad flat ridge or saddle in the delta now has an elevation at its lowest point, near Cierro Prieto (Black Butte Mountain), of about 40 feet above sea level and divides the delta into two parts.

To the east of the ridge, the delta drains southerly into the Gulf of California, and to the west of the ridge it drains to the west and north through the Mexicali Valley and Imperial Valley into Salton Sink, now covered by Salton Sea. The lowest point in the basin is near the north end of Salton Sink, where the elevation is 273.5 feet below sea level - about the same elevation as the lowest point in Death Valley.

Imperial Valley

That portion of the Colorado Desert located in Imperial County of California is now known as Imperial Valley. It is bounded on the north by Riverside County, on the south by Lower (Baja) California, Mexico, on the west by the foothills of the Coast Range of mountains, and on the east by the Chocolate Mountains and Cargo Muchacho Mountains. In early days, before given the name of Imperial Valley, it was known as the "New River Country".

The central portion of Imperial Valley is a part of the delta of the Colorado River. It is a broad flat plain some thirty miles in width, extending from the international boundary line on the south to Salton Sea on the north. It is flanked on either side by mesas at elevations somewhat above the floor of the Valley. Along the easterly side of the Valley is a range of high sand dunes some 40 miles in length, which extends for several miles into Mexico. The cost of building a canal through this barrier of sand dunes was one of the factors making an All-American Canal to Imperial Valley impracticable during the earlier years of development.

This delta portion of Imperial Valley, except for the southeast corner, is below sea level. The elevation of the City of Calexico, on the international

boundary, is approximately sea level, from which point the slope is to the north to the lowest point, already described, near the north end of Salton Sea.

Imperial Valley is one of the most arid sections of the United States, with an annual rainfall averaging approximately three inches and in some years amounting to less than one-half inch. It is an area of intense summer heat - for more than 110 days out of the year, the maximum temperature is in excess of 100 degrees - but with a mild and very favorable climate during the remainder of the year.

The Valley is without a potable local water supply. Water for all purposes - even for domestic use in the cities and on the farms - must come from the Colorado River through the canal system of Imperial Irrigation District.

All of the irrigable land in Imperial Valley is within the service area of Imperial Irrigation District, so the history of the development of Imperial Valley is the history of the District and its predecessors.

Geologic History

Going back into the geologic past several million years, we find an inland sea which included the present Gulf of California and extended through the Colorado Desert and on far to the north through the San Joaquin and Sacramento Valleys. There followed a tremendous upthrust, which was the birth of the mountain ranges which now surround the region, and the Colorado Desert area came up out of the sea. As evidence of this upthrust, very large oyster beds are now found near the mountains on the west side of Imperial Valley not far from the Mexican boundary and marine fossils and shells are found in the San Felipe Valley - to the west of the northerly end of Imperial Valley - many hundreds of feet above sea level.

Following this upthrust, there was a gradual settling of the central portion, and as this went on the Colorado River, as it meandered back and forth across its delta, began disgorging into the area vast quantities of silt eroded from the 240,000 square miles of its drainage basin and its thousands of miles of deep canyons. One has but to stand on the brink of the Grand Canyon of the Colorado in Arizona and look at that great chasm to have some appreciation of the tremendous quantity of material that has been eroded during past ages by the River and spread over its delta.

Gradually the delta extended itself for hundreds of miles southerly into the Gulf of California, and westerly and northerly through the Mexicali and Imperial Valleys. Tests have shown that in some places the River has deposited silt to a depth of as much as 2,000 feet in Imperial Valley.

Lake Cahuilla

There must have been periods of many years when the entire flow of the River was into Imperial Valley. This is evidenced by the vast lake which was formed, the shoreline of which can still be seen at many places around Imperial and Coachella Valleys. This shoreline has an elevation of something over 30 feet above sea level - which is the height at which the lake would overflow back into the Gulf of California. That the water stood at this elevation for hundreds of years is evidenced by the thickness of the travertine deposit on rocks below the water line. The lake, which was identified and given the name

Lake Cahuilla by Dr. W. P. Blake in 1853, was some 110 miles in length, with an average width of about 34 miles and a maximum depth of over 300 feet.

That the Lake was partially filled during other periods of River overflow, is shown by shorelines at lower elevations which are still in evidence. After each filling, the water evaporated and the salts it contained were concentrated in the lowest part of the area, Salton Sink, the residuum of the Lake. At the turn of this century, the dry salt beds of the Sink covered some 150,000 acres and salt was being harvested by the New Liverpool Salt Company at its plant near the north end of the Sink, the lowest part and hence where the greatest salt concentrations were located.

However, records indicate that for at least 500 years before development of Imperial Valley was attempted by man, there had been no major diversion of the River into the Valley for any extended period, and the area had lain a naked burning wasteland, shunned by man and beast alike.

II. EARLY RECOGNITION OF DEVELOPMENT POSSIBILITIES

Capt. A. R. Johnson

Although the discovery by white man of what is now known as Imperial Valley dates back several hundred years, the early crossings from the Colorado River at Yuma to the Coast Mountains on the west side of the Valley occasioned such tremendous hardships that little attention was paid to the topographic features of the area or the possibilities of its development. This was true not just of the early Spanish explorations, but of the crossings even as late as the gold rush of 1849-50.

Lt. Col. W. H. Emory of the United States Army crossed the area in 1846 with an expedition to San Diego. Capt. A. R. Johnson, an officer in Col. Emory's expedition, was probably the first to recognize that the Valley was once covered with water, for he wrote: "At no distant day, this place which is now a dry desert was once a permanent lake." But he made no reference to the fact that the area was below the level of the sea.

Dr. W. P. Blake

In 1853, four expeditions which had been authorized by the Congress were sent out to find a practical route for a railroad between the Mississippi River and the Pacific Ocean. One of these expeditions, in the charge of Lt. R. S. Williamson of the U. S. Topographical Engineers, was assigned the exploration of a southern route and discovered San Gorgonio Pass, a natural gateway from the coast of Southern California into the interior.

It was in the course of this survey that Dr. W. P. Blake, a geologist attached to the Williamson party, made the first scientific examinations of and gave the name to the Colorado River Desert. His report is included in Volume V. Pacific Railway Reports. He noted that what was then the dry bed of Salton Sea and the surrounding area were below sea level, thus presenting the possibility of irrigating Imperial Valley from the Colorado River. He also recognized the fertility of the soil of the area and states in the report:

> "From the preceding facts it becomes evident that the alluvial soil of the desert is capable of sustaining a vigorous vegetation. The only apparent reason for its sterility is the absence of water, for wherever it is kept moist vegetation springs up.
>
> "If a supply of water could be obtained for irrigation, it is probable that the greater part or the desert could be made to yield crops of almost any kind. During the seasons of high water, or of the overflow of the Colorado, there would be little difficulty in irrigating large areas in the vicinity of New River and the Lagoons.
>
> "By deepening the channel of New River, or cutting a canal so low that the water of the Colorado would enter at all seasons of the year, a constant supply could be furnished to the interior portion of the desert. It is indeed a serious question whether a canal would not cause the overflow of a vast surface and refill, to a certain extent, the dry valley of the Ancient Lake. This is possible and would result provided no change of level has taken place since the water dried up."

It will be noted that in the foregoing he recognized the danger of diverting the River into the Desert and a consequent flooding of the area, such as occurred in 1905-07.

Dr. O. M. Wozencraft

Dr. O. M. Wozencraft was probably the first to appreciate fully the importance of the agricultural development and settlement of the lands of the Colorado Desert. He crossed what is now Imperial Valley enroute to San Francisco during the gold rush of 1849 and took part in the birth of the new State of California. Later, after learning of the fertility of the soil in this desert region and the possibility of its irrigation from the Colorado River, he endeavored, commencing in the year 1853, to enlist capital in a plan for its reclamation.

Dr. Wozencraft engaged the services of Mr. Ebenezar Hadley, County Surveyor of Los Angeles County, who recommended a canal location to bring water from the River following the approximate location that was actually adopted some forty years later. Mr. Hadley called attention to the necessity of the canal's passing through Mexican territory, although the diversion point of the River would be "at the point of rocks adjoining Pilot Knob and immediately above the International Boundary Line."

Dr. Wozencraft secured the backing of the State Legislature of California, which by Act approved April 15, 1859, ceded to him "all the right, title, and interest, of the State of California, which the State now has, or which she may hereafter acquire, in and to the land hereinafter described ---." The land described in the Act included, in general, all of what is now Imperial Valley and Coachella Valley. The grant was made upon the condition that within three years from the passage of an act by the United States ceding the lands to California, Wozencraft would provide "a permanent supply of wholesome fresh water along the line of travel between the San Gorgona (sic) Pass and Fort Yuma, and between Cariso (sic) Creek and Fort Yuma, so that there shall be a constant and permanent supply, at all needful and convenient stages and points on the two routes above named." Also, in the same year, the Legislature memorialized the Congress to cede to the State for reclamation and irrigation some 3,000,000 acres of desert land in the Colorado Desert.

Dr. Wozencraft spent many years in Washington, D. C., endeavoring to secure action by the Congress on his plan. One of the bills introduced for this purpose was favorably reported in 1862 by the Public Lands Committee of the House of Representatives, but the Congress, preoccupied with the Civil War, laid the bill aside. Following the war, Dr. Wozencraft renewed his efforts in the Congress but was unsuccessful. His efforts did not cease until his death in 1887.

In 1882, Dr. Wozencraft discussed his plans with Mr. George Chaffey, the developer of Etiwanda and Ontario near Los Angeles, who later built the first canal to Imperial Valley, but at that time Chaffey did not believe white men could withstand the summer heat on the desert and turned down the plan. Chaffey changed his mind later, after his experiences in irrigation development in Australia.

Lt. Eric Bergland

In the years 1875 and 1876, Lt. Eric Bergland, under the direction of Lt. George M. Wheeler, investigated the feasibility of taking water from the Colorado River anywhere between the Grand Canyon and the international boundary line for irrigation of lands in California. There is little doubt but that this investigation stemmed from the activities of Dr. Wozencraft in attempting to secure favorable action on his plan to irrigate Imperial Valley.

Lt. Bergland reported adversely, stating that a canal diverting from the River at some point below the international boundary line would be less expensive and more practicable in every way. He suggested utilizing one of the overflow channels of the Colorado River (doubtless the old Alamo River) from where it leaves the Colorado near Algodones and conveying water to what is now Imperial Valley. He stated that "the water flows into this area from the river when it overflows its banks."

William Denton

At a hearing in San Diego, California, on September 3, 1889, before a Special Committee of the United States Senate investigating the possibilities of irrigation and reclamation of arid lands, one of the witnesses was a Mr. William Denton of San Diego. He testified on the possibilities of irrigating 1,336,320 acres of what he termed "the basin of the Colorado River in San Diego County" (now Imperial County), which area he also referred to as "the New River country".

He proposed two possible plans. The first included a canal from the River southerly some sixty miles to the Cocopah Mountains, then following around to and along the westerly side of the basin, with a branch canal through the sand hills (this would have been an All-American Canal) and along the east side of the basin to the northeasterly end, where it would meet the west side canal.

His second plan contemplated a diversion from the River high enough so that the bed of the canal would be 200 feet above the River at Pilot Knob and then by a canal entirely within the United States to and entirely around the Colorado basin.

He stated that he had been familiar with the Colorado basin for thirty years, but he presented no data as to the cost of his plans or other details involved.

III. PROJECT PLANS AND FINANCING

Colorado River Irrigation Company

Preliminary Investigations

In 1892, Mr. C. R. Rockwood, an engineer who had had considerable irrigation experience in the State of Washington, was sent by Mr. John C. Beatty of Denver to Yuma to investigate the feasibility of irrigating lands in Sonora, Mexico, from the Colorado River. Mr. Beatty was President of the Arizona and Sonora Land and Irrigation Company, the Board of Directors of which included several of the leading financial men of Colorado.

During Rockwood's investigation of the Sonora project, which was subsequently found by him to be infeasible, he made a trip to the Colorado Desert and immediately recognized the possibilities of developing that area with water from the Colorado River. As a result of his favorable preliminary report on these possibilities, the name of the company was changed in 1893 from Arizona and Sonora Land and Irrigation Company to Colorado River Irrigation Company. Mr. Rockwood was given assurances by the new company of financial backing if additional surveys confirmed his preliminary report, and he was made Chief Engineer.

In July, 1893, following more extensive investigations and surveys, Rockwood reported to Beatty on a project for the Colorado Desert to irrigate 800,000 acres in Lower Califonia, Mexico, and some 1,250,000 acres in an area "known as the Salton Basin". This report describes the Salton Basin as extending from the international boundary northwesterly to Indio, a distance of about ninety miles, and from the San Jacinto Mountains on the west to the sand hills and the San Bernardino Mountains on the east. It is interesting to note that the project proposed by Rockwood covers the same area, essentially, as that now included within the service area of the All-American Canal.

Of this area in the Salton Basin, Rockwood proposed, as a first development, that there be included under the canal the lands in San Diego County (now Imperial County) lying between the Salton Sink (the dry bed of Salton Sea) and the international boundary, of which he estimated 750,000 acres would be irrigable. Rockwood also recognized that Salton Sink had value and would be required as an area in which to evaporate the waste and drainage waters from the irrigation project.

Survey of Canal Location

The main canal recommended by Rockwood, which was staked on the ground, had its heading on the Colorado River at Potholes (this is approximately the same location as the present Laguna Dam). From the intake, the location was to the southwest away from the River (paralleling the present location of the All-American Canal) to a point he called "El Rio" near Pilot Knob, where the River was again reached. The next three miles to the south of El Rio was adjacent to the River, to avoid Pilot Knob Mountain. Here the canal would cross into Mexico and swing to the west away from the River around the south end of the range of sand dunes, continuing westerly south of and nearly parallel to the international boundary line for a distance of about 37 miles before turning to the north for

five miles and re-entering California on the East Mesa of Imperial Valley. He carried his survey on north in Imperial Valley to the Southern Pacific Railroad at Flowing Wells, which is some miles to the east of the present town of Niland.

From the 37-mile point, referred to above, which he called the "East Branch Fork," he proposed, but did not survey, a canal to the west and north through the center of Imperial Valley. He also proposed another canal to serve the west side of the Valley. He recommended that at the start only the central canal be built, the others to follow as finances permitted.

At El Rio he proposed to construct a sluiceway back to the River and to install a power plant utilizing the drop of about 25 feet between the canal and the River. The power would be used to operate silt pumps in the canal at the heading and the surplus sold for commercial purposes. The sluiceway would flush out of the canal the coarse silt which was not removed at the heading. The canal was to have excess capacity down to El Rio for these purposes.

Attempts were made, both in this country and in Europe, to finance the project, but all were unsuccessful, due in no small part to the panic of 1893. As a matter of fact, the Company could not even pay for the surveys and other incidental expenses, with the result that, under a court judgment in 1894, all of its personal properties were awarded to Rockwood.

Change in Plans

Rockwood continued his endeavors to secure financing for the project, bringing several new associates into the Company, but all such efforts proved unsuccessful. Because of his failure to secure the necessary backing, Rockwood was forced to drop the plan of having the canal divert from the River at Pot-holes as being too expensive to finance at that time.

The location for the diversion was changed to a point in California at Pilot Knob immediately above the international boundary line on a tract of land owned by Hall Hanlon, later known as Hanlon Heading, from which point the canal would pass through Mexico for some 60 miles, reaching the international boundary again at a somewhat lower elevation and to the west of the point where the original canal location crossed to the East Mesa of Imperial Valley. Also, as a measure of economy, he proposed to utilize an old overflow channel of the River, known variously as the Alamo, Salton, or Carter's River, for the greater part of the distance of the route through Mexico.

California Development Company

Organization

Because of legal difficulties in which the Colorado River Irrigation Company was involved, and in the interest of getting a new start on financing, Mr. Rock-wood and his associates organized the California Development Company - hereinafter referred to as the C. D. Company - under the laws of New Jersey, on April 25, 1896, with a capital stock of $1,250,000 consisting of 12,500 shares with a par value of $100 each. An issue of Company scrip not to exceed $3,750,000 in amount was also authorized. Mr. A. H. Heber of Chicago, Illinois, was made President and Rockwood the Vice President.

According to its Certificate of Organization, the Company could construct and operate headings, dams, ditches, canals, reservoirs and other structures for collecting, storing and conducting water and irrigating land; supply and distribute water to, and irrigate and cultivate the lands of the Company and of others; sell or let such water or the right to use the same; acquire, sell or let land and other real estate in the United States and Mexico and water rights and franchises; colonize such land and develop and improve it; construct railways and other means of transportation, telegraphs, telephones and other means of communication, plants for power, light, water works, or manufacturing, of any description, and operate by steam, gas or electricity; acquire in any lawful manner capital stock, bonds, notes or securities of other corporations organized to acquire, construct, maintain or operate works of the nature described; and lay out townsites.

A copy of the Articles of Incorporation of the Company was filed with and certified by the Secretary of State of California under date of November 23, 1901, as required by act of the State Legislature approved March 8, 1901.

In 1899, Rockwood was made President, which position he held until the contract with Mr. George Chaffey, discussed at a later point, was made in 1900, at which time Chaffey became President.

Attempts to Finance

Rockwood and his associates continued efforts to secure financial backing for the project, and although on several occasions it appeared they would be successful, in each case events intervened causing their efforts to end in failure.

As an example, Mr. W. A. Forbes, a Boston financier, and his associates were very much interested in the project, and it appeared that he was willing to finance the enterprise provided an engineer of his selection reported favorably on it. George G. Anderson, of Denver, an engineer with considerable experience in irrigation reclamation, investigated the proposed project and, under date of November 16, 1896, made his report to Mr. Forbes.

In his report, Mr. Anderson approved of the change in the diversion point from Potholes to Hanlon Heading, with a canal to the Valley, from the latter point, on the basis of the first cost being less, and with the former plan to be retained for "possible future developments". He also approved of the changed canal location as planned by Rockwood, which would include a canal some 11.5 miles in length from Hanlon Heading to a junction with Salton (Alamo) River and the use of the latter as the canal for about 50 miles in Lower California. In fact, he gave a very strong recommendation of the entire project and its plan of financing. However, Mr. Forbes, because of poor health, did not go ahead with the deal and died a few months later. It is interesting to note Mr. Anderson's early connection with the project, as in later years he was to serve Imperial Irrigation District on a board of consultants reporting on diversion, flood control and other District problems.

George Chaffey

All efforts to finance the project failed until 1899 when negotiations with Mr. George Chaffey resulted in his agreeing to take hold of the project. Under a contract dated April 3, 1900, he was given full control of the California

Development Company and the Mexican subsidiary company, described later, for a period of five years. In return, Mr. Chaffey was to finance and construct the headworks and a canal to take water from the Colorado River at a point in California immediately above the international boundary (Hanlon Heading), through Mexico to the point where it would cross back into the Imperial Valley of California, at a cost of not to exceed $150,000. The canal was to have a capacity to deliver 400,000 acre-feet per annum at the point of crossing of the canal into Imperial Valley. Chaffey was to be repaid the actual cost of the work and, in addition, $60,000 for his personal services over the five-year period.

After making his own investigations, Mr. Chaffey adopted, in general, the Rockwood plan of constructing the canal from the diversion point into Mexico to a connection with the Alamo overflow channel. He found that with a small amount of work at various points along this channel, it could be used for some 50 miles to a point, later known as Sharp's Heading, near the international boundary line and about 8 miles east of the present City of Calexico. From this point, canals could be constructed to the international boundary line from which a large part of Imperial Valley could be served.

Naming Imperial Valley

It was at about this time (1900) that Imperial Valley received its name. The area had been known variously as the Colorado Desert, Salton Basin, or the New River Country, none of which appeared to be appropriate to Rockwood and his associates; hence the name "Imperial Valley" was chosen.

The Mexican Company

From the first surveys, it was apparent that the canal would have to pass through a portion of lower (Baja) California, Mexico in order to reach Imperial Valley. A tract of some 900,000 acres lying west of the River in Lower California was owned by a General Andrade, who at the time was the Mexican Consul in Los Angeles, title to which having been issued to him by the Mexican Government on August 7, 1888. In May 1895, the Colorado River Irrigation Company had secured an option to purchase some 350,000 acres of the Andrade lands along the international boundary in Lower California. This land would not only furnish ample right of way for the new canal, but it was felt could be easily developed as a part of the project.

However, payments under this option lapsed, and a second option was secured by the newly organized C. D. Company in the latter part of 1896, on 100,000 acres of the Andrade lands in a strip adjacent to the international boundary line, extending from the Colorado River to the west side of the Mexicali Valley. Subsequent investigation of the laws of Mexico revealed that an American comany could not hold title to Mexican lands. For this reason, the C. D. Company organized a Mexican corporation in 1898 known as La Sociedad de Yrrigacion y Terrenos de la Baja California, S. A. - hereinafter referred to as the Mexican Company - with a capital stock of $62,500, made up of 12,500 shares with a par value of five dollars each.

In the initial organization, 12,000 shares of the stock went to Andrade as payment for his 100,000 acres of land and the other 500 shares were taken by officers of the C. D. Company.

The list of objects for which the Company was formed, as stated in its Articles of Incorporation, is similar in all respects to that included in the

Articles of Incorporation of the C. D. Company, which has heretofore been given.

Later, after Chaffey was given control of the California Development Company, that Company, under the option previously referred to, acquired all of Andrade's interests in the Mexican Company, which put both companies under the same ownership, management, and control.

Mutual Water Companies

Plan of Colonization

Prior to 1900, Imperial Valley was an uninhabited desert waste, without transportation or communication facilities except for one or two desert trails and the Southern Pacific railroad which cut across the northern end of the Valley some fifty miles north of the international boundary. Except for two State school sections in each township, the area was in large part public lands of the United States. (In the northern part of the Valley, north of the Third Standard of Parallel, the Southern Pacific Company owned the odd-numbered sections in each township, which it had received under the railroad land grants from the Federal Government.) This was the area the C. D. Company proposed to colonize and irrigate.

The method of colonization decided upon by the C. D. Company was to utilize the mutual water company type of organization, which had been quite successful in other parts of California. The companies would be owned by the settlers through the purchase of water stock, which they would locate on their land, and the funds received from such sales to be used in building the canal system.

Accordingly, the C. D. Company divided the Valley into districts of varying size, each to comprise a mutual water company, which would be organized as development of the canal system progressed.

First Mutual Water Company

The first to be organized was Imperial Water Company No. 1, known as No. 1 Company, on March 29, 1900, with an area of about 100,000 acres (later increased to nearly 150,000 acres) in the south-central part of the Valley immediately north of the international boundary line and east of New River. It had a capital stock of 100,000 shares of water stock, each share to represent one acre of irrigable land. In later years, the acreage per share of stock for this and the other water companies was varied from time to time.

Additional mutual water companies later organized are discussed at another point.

Interrelated Contracts between Companies

Mexican Company and No. 1 Company

Under date of April 6, 1900, the Mexican Company entered into a contract with No. 1 Company under which the former agreed to deliver to the latter, at a point on the international boundary line to be agreed upon, 4 acre-feet of water per acre per year for each share of stock issued by No. 1 Company and located on lands within No. 1 Company's boundaries, but not to exceed a total of 400,000

acre-feet in any one year. (This is the 400,000 acre-feet referred to in the Chaffey contract.) No. 1 Company agreed to pay fifty cents per acre-foot for the water delivered to it.

Furthermore, the Mexican Company was to have the exclusive right to sell all shares of water stock issued by No. 1 Company, with certain stipulations as to selling price and the sharing by No. 1 Company in the monies received therefrom.

C. D. Company and Mexican Company

Under date of December 28, 1900, a contract was entered into between the C. D. Company and the Mexican Company in which reference was made to the contract of April 6, 1900, between the latter company and No. 1 Company and to the intention of the Mexican Company to make similar contracts with other mutual water companies. Under this contract, the C. D. Company agreed to deliver sufficient water to the Mexican Company at the international boundary line at Hanlon Heading to enable the Mexican Company to supply lands in Imperial Valley and in Mexico. Furthermore, the C. D. Company agreed to construct, operate, and maintain the main canal system in Mexico.

In return, the Mexican Company relinquished to the C. D. Company all of its rights in the water stock of the mutual water companies and to any monies received from the sale of such stock. Furthermore, the Mexican Company agreed to pay over to the C. D. Company all monies it received for delivery of water at the international boundary line to the mutual water companies.

Tri-Party Contract

Under date of July 24, 1901, a contract was entered into between the Mexican Company, No. 1 Company, and the C. D. Company, known as the Tri-Party Contract, which rescinded the contract of April 6, 1900, between the Mexican Company and No. 1 Company, and in its place made the following main provisions:

1. The Mexican Company agreed to deliver the 4 acre-feet per acre but not to exceed 400,000 acre-feet per year, to No. 1 Company at the international boundary line near Calexico.

2. The C. D. Company was given the exclusive right to sell, and retain the monies received therefrom, all of the capital stock (water shares) of No. 1 Company except 2,500 shares which were to be retained by the latter as Treasury Stock to be disposed of from time to time as required for running expenses of the Water Company.

3. The C. D. Company agreed to construct, operate and maintain a main canal through the lands of No. 1 Company and also to construct a lateral distribution system from the main canal to deliver water to the high point of each 160-acre tract of land on which water stock was located, such distribution system to be operated and maintained by No. 1 Company.

4. The water to be received by No. 1 Company from the Mexican Company was to be delivered by the C. D. Company into

the main laterals of the distribution system and measured at such delivery points with an allowance of two percent for lateral losses (thus it was intended that No. 1 Company was not to pay for water lost between the international boundary and the land served; however, experience showed that the two percent allowance for loss was much too low and in later years it was materially increased, with an allowance made also for water wasted for regulating purposes).

5. No. 1 Company was to pay the Mexican Company at the rate of fifty cents per acre-foot and this price was never to be increased.

Similar contracts were later made with most of the other mutual water companies, but several elected to build their own distribution systems and receive water at the international boundary line, or where the main canal entered their area.

Imperial Land Company

To handle the colonization of the land and the sale of water stock, the C. D. Company organized the Imperial Land Company in March of 1900. Under date of April 9, 1900, the C. D. Company entered into a contract with the Land Company by which the latter Company was appointed the exclusive agent of the C. D. Company for a period of ten years, to sell the water stock of Imperial Water Company No. 1 and other water companies to be formed, and also to lease and sell the lands of the Mexican Company. The contract recited the fact that the C. D. Company owned all of the Capital stock of the Mexican Company. The Land Company was to advertise extensively and otherwise push such sales vigorously at its own expense. In payment for its services, the Land Company was to receive a commission of 25 percent of the monies received from such sales and leases. Other terms of the contract dealt with minimum prices to be charged for and conditions of sale of the water stock. (It had been intended to sell the water stock for $10 a share, but conditions were such that much of it sold at $5 and some of it for even less.)

The water stock had to be sold on very easy terms, as most of the settlers were of moderate means and could make only small down payments. The water stock was not appurtenant to the land, so the purchase price had to be secured by personal notes of the purchaser, to which the water stock was pledged as security.

The contract was abrogated in 1906.

Delta Investment Company

These notes for water stock were turned over to the C. D. Company, which had difficulty in trying to raise funds by borrowing on them. For this and other reasons, Chaffey and his associates organized the Delta Investment Company in the fall of 1901, with assets consisting solely of stock of the C. D. Company and Imperial Land Company. The Investment Company was given a contract to take over all of the C. D. Company's bonds, notes, and mortgages at 50 cents on the dollar. This provided some money to the C. D. Company for construction purposes, but it cost the Company two dollars for every one dollar thus obtained.

The contract was in effect for only a short time, being cancelled in February 1902, when a settlement was made with Chaffey and he withdrew from the C. D. Company and all of its activities.

IV. ORIGINAL WATER APPROPRIATIONS

1895-1899

Commencing in 1895 and continuing through 1899, a series of water appropriations was made by individuals and also by the California Development Company under the existing laws of the State of California, by posting notices at the intended point of diversion and recording them with the County Recorder of San Diego County (Imperial County was not organized until some time later). Each of these appropriations was for a flow of 10,000 cubic feet per second of the water of the Colorado River, with the point of diversion described as being on the west bank of the Colorado River in the S. W. ¼ of Section 25, T. 16 S., R. 21 E., S. B. B. & M., in San Diego County, State of California, one and one-quarter miles, more or less, up the River from the point where the international boundary between the United States and Mexico intersected the west bank of the Colorado River.

The purpose of the appropriations were stated to be for the developing of power and for the irrigation of lands in Lower California, Mexico, and San Diego County, California, by means of a canal which was to run from the diversion point in the United States through Lower California, Mexico, and back into the United States "into that portion of San Diego County, State of California, lying to the east of the San Jacinto Mountains and known as the "New River Country". Subsequently the rights of the individuals were assigned to the California Development Company.

A tabulation listing the more important notices filed, together with the dates of recording and transfer of rights to the C. D. Company, follows:

Name on Water Filing	Date Filing Posted	Date Filing Recorded	Date Transferred to C. D. Company	Date Transfer Recorded
E. I. Rockwell	May 16, 1895	May 18, 1895	Aug 15, 1911	Aug 19, 1911
W. T. Gonder	Jul 15, 1895	Jul 17, 1895	Jan 25, 1899	Feb 1, 1811
W. T. Heffernan	Sep 13, 1895	Sep 16, 1896	Jan 18, 1899	Feb 1, 1899
W. T. Gonder	Nov 12, 1895	Nov 14, 1895	Jan 25, 1899	Feb 1, 1899
C. D. Company	Dec 15, 1898	Dec 19, 1898		
W. T. Gonder	Jan 14, 1896	Jan 16, 1896	Jan 25, 1899	Feb 1, 1899
W. T. Heffernan	Mar 16, 1896	Mar 18, 1896	Jan 18, 1899	Feb 1, 1899
W. T. Heffernan	May 16, 1896	May 18, 1896	Jan 18, 1899	Feb 1, 1899
W. T. Heffernan	Oct 20, 1896	Oct 23, 1896	Jan 18, 1899	Feb 1, 1899
W. T. Heffernan	Jan 23, 1897	Jan 25, 1896	Jan 18, 1899	Feb 1, 1899
W. T. Gonder	Mar 27, 1897	Mar 29, 1897	Jan 25, 1899	Feb 1, 1899
W. T. Heffernan	Jul 24, 1897	Jul 26, 1897	Jan 18, 1899	Feb 1, 1899

Name on Water Filing	Date Filing Posted	Date Filing Recorded	Date Transferred to C. D. Company	Date Transfer Recorded
W. T. Gonder	Apr 25, 1898	Apr 28, 1898	Jan 25, 1899	Feb 1, 1899
C. D. Company	Oct 15, 1898			
W. T. Gonder	Nov 4, 1898	Nov 7, 1898	Jan 25, 1899	Feb 1, 1899
C. N. Perry, for himself & C.D. Co.	Dec 21, 1898	Dec 24, 1898 re-recorded on Jan 5, 1899	Dec 21, 1898	Dec 24, 1898 re-recorded on Jan 5, 1899
C. N. Perry, for himself & C.D. Co.	Feb 20, 1899	Feb 23, 1899	Feb 20, 1899	Feb 23, 1899
C. N. Perry, for himself & C.D. Co.	Apr 25, 1899	May 2, 1899	Apr 25, 1899	May 2, 1899

V. EARLY DEVELOPMENT

First Construction

Alamo Canal

Following the execution of his contract of April 3, 1900, Chaffey found that, contrary to citations in the contract, the C. D. Company did not own Hall Hanlon's land, in fact the option to purchase the land had lapsed due to failure of the Company to meet the payments required, and neither did the C. D. Company own all of the capital stock of the Mexican Company and therefore did not own the 100,000 acres of Andrade's land in Lower California through which the canal was to run. As a consequence, before Chaffey could start construction he had to acquire both the Hanlon property and Andrade's interests in the Mexican Company.

Actual excavation of the intake canal at Hanlon Heading commenced in August 1900 with a four-yard dipper dredge which Chaffey had purchased at Yuma. The point of diversion from the River was a short distance downstream from the present Rockwood Heading. From there, the canal was excavated to the international boundary line and on into Mexico for a distance of between four and five miles; it then swung to the west for two or three miles to a connection with the old Alamo River channel. For the next forty miles, to what became known as Sharp's Heading, where the Alamo turned north to Salton Sink, only a minimum amount of work was done on the channel to make it serviceable as a canal.

From Sharp's Heading, a canal (Central Main) was constructed on to the west and northwest, to the international boundary line at a point about four miles east of the present city of Calexico. A lateral canal (Boundary Canal) was built from this point westerly along the boundary to Calexico.

Chaffey Gate

The River head gate (Chaffey Gate) was constructed in the intake canal some five hundred feet north of the international boundary line in California and downstream from the present Hanlon Heading structure. The open canal between the head gate and the River, several thousand feet in length, was known as the Intake Canal.

The Chaffey Gate, construction of which commenced in March, 1901, was a wooden A-frame flashboard-controlled type of structure, 70 feet in length, 15 feet in height, with a planked floor, and founded on piling. According to Chaffey's plans, this was a temporary gate of limited capacity, and it was to be replaced with a concrete structure of larger capacity as soon as revenues would permit (this was actually done in 1906). The floor of the Chaffey Gate was not placed as low as it should have been, due to difficulties with ground water, resulting in diversion troubles during low-flow periods of the River.

First Diversion and Delivery of Water

Construction had progressed far enough that on May 14, 1901, the first diversion was made from the River to the new canal. This event was noted by Chaffey in a telegram to his son, which read:

Ogilby, Cal., May 14, 1901

A. M. Chaffey, 244 Stowell Block, Los Angeles. --
Water turned through gate at 11 a.m. Everything
all right.

George Chaffey

The first delivery of water in the United States occurred in June, 1901, when delivery was made as far as Calexico through the Boundary Canal. Some 1500 acres was put under crops in the fall of that year.

Additional Mutual Water Companies

As already noted, Imperial Water Company No. 1 was organized in 1900. Later in the same year, Imperial Water Company No. 4 (20,000 acres) was organized, followed in 1901 by Imperial Water Companies No. 5 (100,000 acres) and No. 6 (20,000 acres), and in 1902 by No. 7 (18,000 acres) and No. 8 (45,000 acres). Tri-Party contracts were entered into by each, which in general, except for that of No. 6 Co., were similar to the one heretofore described for No. 1 Company. No. 7 Company bought its water rights from the C. D. Company for a lump sum cash payment of $50,000 and built its own distribution system; the C. D. Company built the distribution systems for the others.

No more water companies were organized until 1908. These are discussed at a later point.

Additional Construction

Canals

The Central Main Canal was continued on from the international boundary line through No. 1 Company to its north limits (No. 4 Heading), a few miles to the southwest of the present city of Brawley, and put into service in March 1902. From this point, water service was furnished to Water Company No. 4. A branch canal from the Central Main, with a crossing by flume of what was then the relatively narrow and shallow channel of New River, was constructed to provide service to Water Company No. 8.

The Encina Canal - now West Side Main - was constructed in Lower California from Sharp's Heading to the south, crossing New River channel in a flume, then swinging to the west and north to the international boundary line at a point about ten miles west of Calexico, for providing service to Water Co. No. 6.

Diverting from the Alamo Canal about 1-½ miles upstream from Sharp's Heading, the East Side Main Canal was constructed north to the international boundary line (Allison Heading) to serve Water Co. No. 7.

For service to Water Co. No. 5, the original plan utilized the old Alamo River channel as a canal from Sharp's Heading to Holtville, where an earthern dam was constructed in the channel to raise the water high enough to make delivery. However, the dam failed within a short time, and No. 5 Company built a main canal from Allison Heading north to its lands; this became known as the Low Line or No. 5 Main Canal.

By January 1, 1905, there had been constructed eighty miles of main canals in the Imperial and Mexicali Valleys belonging to the C. D. Company and the Mexican Company and some seven hundred miles of distribution canals in Imperial Valley.

Structures

In addition to the Chaffey Gate and other structures already mentioned, major structures built during the first years included: head gates for the Central Main and Encina Canals and a waste gate to the Alamo River, all at Sharp's Heading, and the 134 Waste Gate on the Central Main Canal in Mexico about two miles downstream from Sharp's Heading, which discharged into a side channel of New River.

Holton Power Plant

From a point on the No. 5 Main Canal southeast of Holtville known as No. 5 Heading, W. F. Holt, developer of No. 7 Water Company, the town of Holtville, and other enterprises, built a canal to the Alamo River where he installed a small hydroelectric plant in 1903-04 with a head of about 20 feet. This was the start of the Holton Power Company and supplied the first electric service to Holtville and El Centro. Water for the plant was secured from the C. D. Company by a special contract and when available up to 150 second-feet was used for power purposes. The deepening of the Alamo River by flood waters from the river break of 1905-07 increased the available head at the plant about 25 feet, and a second hydro plant was built to utilize the increased head. The two plants had a capacity of about 1500 kilowatts.

Concession from Mexican Government

From the discussion which has been given of the Mexican Company relating to the various contracts in which it became involved, as well as its intended purpose of selling or leasing water to serve lands in Mexico in addition to those it owned, it can be seen that the Company was, in fact, a public utility; but the right to operate as such had not been granted by the Mexican Government. Moreover, as will be referred to at a later point, questions arose as to the right of the C. D. Company to appropriate water from the Colorado River under California State law, since the River was considered navigable and such right had not been recognized by the United States Government; hence it appeared desirable to the C. D. Company to secure the right, if possible, to divert water from the River in Mexico.

These were among the reasons why the C. D. Company, through its subsidiary, the Mexican Company, sought a concession from the Mexican Government to legalize all of the activities of the latter Company.

Such a concession, or contract, was obtained under date of May 17, 1904, being approved by action of the Mexican Congress and the President under date of June 7, 1904.

The concession authorized the Mexican Company to carry through its canal system in Mexico, 284 cubic meters per second (10,000 second-feet) of water to be diverted from the Colorado River in the United States by the C. D. Company and turned over to the Mexican Company at the international boundary line. It also authorized the Mexican Company to divert from the Colorado River in Mexico, 284 cubic meters per second (10,000 second-feet) of water to be carried through its canal system, provided that such diversion did not injure the

rights of a third party or "the navigation so long as the river is destined for navigation". In both cases, the Company was authorized to carry the water through its canal system for irrigation of lands in the United States, provided that, of such water, enough should be used for the irrigation of lands in Lower California susceptible of irrigation from said system without "exceeding one-half of the volume of water passing through said canals". (In later years, this provision of the concession was interpreted by the Mexican Government to mean one-half of the flow at any given time, after deducting the amount of water required for regulatory use and losses in Mexico.)

Among other important provisions of the concession were the following: All actions of the Mexican Company under the concession were to be subject to the inspection of an engineer to be appointed by the Mexican Government, the Company being required to contribute $300 (pesos) per month toward his expenses. The Company was to be considered a public utility and have the right of eminent domain, with provision for carrying out such right. The prices at which water was to be sold by the Company were to be subject to the control of the Government. The Company was prohibited from selling or mortgaging the concession to, or admitting to partnership in the concession, any government or foreign state, the concession to be nullified and become extinct in the event these provisions, among others, were violated. All or any of the stockholders of the Company could be foreigners, but such stockholders and the Company would be subject to the jurisdiction of the Courts of Mexico. Such stockholders or the Company were prohibited from alleging the right of foreigners under any circumstances and should have only the rights under the laws of Mexico granted to them as Mexicans; neither should there be any interference in the affairs of the Company by foreign diplomatic agents.

In connection with the granting of this concession, it is interesting to note that by letter dated November 27, 1901, to John Hay, Secretary of State of the United States, from M.' de Aspiroz of the Mexican Embassy, the Government of Mexico had protested diversions from the Colorado River by the C. D. Company in the United States as being in violation of the navigation provisions of the treaties of 1848 and 1853. The protest was referred to the United States Department of Justice for investigation and report. In reply, that Department submitted a report by Mr. Marsden C. Burch, a Special Attorney of the Department, dated September 28, 1903, which held that such diversion of water, being wholly within the United States, was not in conflict with the provisions of any of the treaties. Apparently the Government of Mexico concurred in this opinion when it granted the concession in 1904 to the Mexican Company to take through Mexico the waters diverted by the C. D. Company in California. It will be noted that the only reference in the concession to navigation applied to the additional 10,000 second-feet which the Mexican Company was given the right to divert from the River in Mexico.

Progress of Valley Settlement

Settlers and Irrigation

In view of the conditions which had to be faced, the early colonization of Imperial Valley made very good progress. At the start, the settlers had to come to an uninhabited barren desert, with a very severe summer climate of heat and dust. The only local water available for domestic purposes was to be found in two or three small shallow lakes along the course of New River, which received some replenishment from overflow during the flood seasons on the Colorado River.

However, by late summer, the water became so brackish, it could not be used for domestic purposes, which meant that until canal water was available, domestic water had to be hauled from the Southern Pacific railroad at Flowing Wells in the north end of the valley, to which point it was brought by tank cars from Coachella Valley. Of course, there was no ice, electricity or gas available. The only roads were a few trails crossing the desert.

On January 1, 1901, the only white men in the Valley were the surveyors engaged in laying out the canals. A year later it was estimated that 2,000 people had come to the Valley. By January 1, 1904, the population was 7,000, and the year after that it was between 12,000 and 14,000.

As before noted, the first 1,500 acres of land was put into crop in the latter part of 1901. By the end of that year, 125,000 acres had been filed on. Land irrigated in 1902 amounted to 12,000 acres, with a total of some 100,000 acres under the canal system by the end of that year. By April 1903, there was an estimated 25,000 acres in crop, and by April 1905, 67,000 acres. In April 1905, the irrigated area was 80,000 acres, increasing in the following winter to 100,000 acres, with a further increase in 1911 to 220,000 acres. It is believed this record constitutes the most rapid development of any reclamation project in the west.

Water Shortages

Settlement was more rapid than had been anticipated and overtaxed the facilities and resources of the C. D. Company. As a result, the first shortage of water occurred in the winter of 1902-03, due in part to the fact that the main canal at the intake had not been completed to its final depth, and also to much more difficulty than had been expected from the silting of the Intake Channel from the River to Chaffey Gate. This latter condition may be attributed in part, perhaps, to the fact that the sill of the Chaffey Gate was not at as low an elevation as it should have been.

In the winter and early spring of 1904, another water shortage occurred, causing some crop damage, and claims amounting to $500,000 were filed against the C. D. Company. These claims were settled out of court by the Company, with total payments of less than $35,000.

Branch Railroad

Transportation was a very serious problem in the Valley during the first few years, all materials and supplies having to be freighted overland from the Southern Pacific railroad at Flowing Wells. There was a similar problem in the shipment of the products grown in the Valley. As a result, the Southern Pacific Company was petitioned to construct a branch line running through the Valley from the main line. When the Southern Pacific failed to get construction of the branch underway promptly, local citizens purhcased right of way and materials with the intention of doing the job themselves. This brought immediate action from the Southern Pacific. By February 1903, the branch line had been completed from Old Beach (now Niland) southerly to Imperial, and by January 1904 had been extended on to Calexico.

The Company planned to carry the line from Calexico in a loop through Lower California, Mexico and back into the United States near Hanlon Heading, connecting with the main line again a few miles west of Yuma. The proposed

construction had been completed from Calexico - Mexicali to Cocopah, some fifteen miles to the east, when the flood waters from the 1905 break of the River into the Valley held up further progress for several years. In connection with the closing of the break, the other end of the loop was built to a point some six miles south of Hanlon Heading. In the fall of 1907, following the closure of the break, the remaining section of the loop was constructed. This portion of the Southern Pacific line in Lower California, Mexico, is known as the Inter-California Railroad.

The branch line was of material assistance in relieving the transportation difficulties, giving the Valley rail connections both to the east and to the west. In 1919, the San Diego and Arizona Eastern Railroad was completed from San Diego to El Centro, which gave the Valley another means of transportation to the Coast.

Imperial County Organized

When development started, Imperial Valley was a part of San Diego County, which stretched from the Pacific Ocean along the international boundary line to the Colorado River. In order to reach the County Seat, which was the City San Diego, Valley people had to travel nearly three hundred miles. There being no road from the Valley directly across the mountains to San Diego, it was necessary to go north to Riverside and then back to San Diego. Because of this situation, and in order that the newly developed Imperial Valley might have its own government, Imperial County was organized in August 1907, with El Centro being designated as the County Seat. The new County included all that part of San Diego County lying to the east of the Coast Range of Mountains.

Establishment of Valley Towns

Layout of Townsites by Imperial Land Company

In its contract with the C. D. Company, the Imperial Land Company, heretofore referred to, was given the exclusive privilege of laying out townsites in the Valley. The Land Company, through the use of Government scrip, was able to secure immediate ownership in fee simple of tracts of land in various parts of the Valley, which were subdivided into townsites. Most of the townsites were covered with water stock, in order to obtain water for domestic and municipal use from the mutual water company in which each was located.

As has been noted, there was no local potable water supply available, making it necessary then, as is the case now, for all water requirements - irrigation, domestic, municipal, and stock - to be imported from the Colorado River through the irrigation canal system. There are few, if any, other areas in the United States which are so dependent upon the importation of water for all of their requirements.

Of the Valley towns, the Land Company established the townsites of Calexico, Heber, Imperial, and Brawley. The Land Company also laid out the townsite of Mexicali in Lower California, immediately across the international boundary line from Calexico.

Imperial

The town of Imperial was the first to be laid out. This was in December 1900, and settlement commenced early in 1901. For most of the first year, the

only water available was that hauled from the small lakes along New River or from Flowing Wells. Water from the Colorado River through the new canal system reached the town sometime in the late summer or early fall of 1901. Imperial was incorporated July 14, 1904.

Calexico

The land occupied by the present City of Calexico was filed on by Chaffey in 1901 and donated by him for townsite purposes. The first survey parties used in laying out the canal system established their camp in 1900 at Cameron Lake on New River, a short distance to the northwest of the present City of Calexico, moving to the new townsite shortly after it was laid out in 1901. Calexico from then on became the engineering and operating headquarters for the C. D. Company and later for Imperial Irrigation District until the District's offices were moved to Imperial in 1925. Calexico was incorporated April 16, 1908. It is interesting to note that the names of both Calexico and Mexicali are derived from the names California and Mexico.

Brawley

Originally the townsite of Brawley was located by a Mr. J. H. Braly, a banker of Los Angeles, who owned a large portion of the stock of No. 4 Water Company and who had been given the right to locate a townsite within the area of that Company. However, before the town was started, the townsite property was purchased from him by the Imperial Land Company and the town platted early in 1903. It had been intended to name the new town Braly, but Mr. Braly refused to have his name used in connection with the town, so instead it was named Brawley. It was incorporated in April, 1908.

Silsbee

In 1902, the townsite of Silsbee was laid out on the shores of what was then Blue Lake. However, flood water from the break in the Colorado River of 1905-07 submerged the town and finally a large part was engulfed in the gorge of New River, which these flood waters created. Later the entire townsite was abandoned.

Holtville

The townsite of Holtville was laid out in 1903 by W. F. Holt, after whom the town was named. The original name give the town was Holton, but was changed to Holtville at the request of the Post Office Department to avoid confusion in names with Colton, California. Among his other properties, Mr. Holt owned a large block of the stock of No. 5 Water Company and had been given the townsite rights in the territory of that Company. Holtville was incorporated June 29, 1908.

Heber

The townsite of Heber was selected in 1903 on what was the proposed location of the branch railroad line. The original name given the town was Bradtmoore but was later changed to Heber by the Imperial Land Company. Heber failed to develop as had been anticipated and has remained one of the smaller towns of the Valley.

El Centro

In 1904, W. F. Holt and C. A. Barker purchased a tract of land about four miles south of Imperial, which was later to become the City of El Centro. The original name given the town was Cabaker - apparently derived from C. A. Baker- but it was later changed to El Centro. Rivalry sprang up immediately between this new town and Imperial, the latter having been the leading town of the Valley up to that time. However, Mr. Holt constructed a railroad from the new town to Holtville, called the Holton Inter-Urban Railroad, and this, together with the election of El Centro as the County Seat when Imperial County was organized, settled the issue. As a result, the growth of El Centro was much more rapid than that of Imperial, and today the former is the largest town in the Valley. El Centro was incorporated April 16, 1908.

Seeley

The townsite of Seeley was laid out in 1911, about nine miles west of El Centro, by A. R. Ferguson and others. Like Heber, Seeley failed to develop as had been anticipated, and although there has been more growth of recent years, it still remains one of the smaller towns of the Valley.

Westmorland

The townsite of Westmorland was laid out in 1910 by the Oakley Company, which at the time was one of the larger real estate firms in the Valley. The town is located some six miles to the west and four miles to the north of Brawley and has had a slow but continued growth. A branch railroad was completed by the Southern Pacific Company from Calipatria to Westmorland in 1917. Westmorland was incorporated July 18, 1934.

Calipatria

In April 1914, the townsite of Calipatria, located on the Valley line of the Southern Pacific railroad about ten miles north of Brawley, was laid out and placed on the market. It developed rapidly at the start but did not continue to do so to the extent enjoyed by El Centro and Brawley. It was first known as Date City but the name was later changed to Calipatria. It was incorporated February 28, 1919.

Niland

Niland, previously known for some years as Old Beach and also as Imperial Junction, is located at the junction of the main line of the Southern Pacific and the branch to Imperial Valley. It was established in March, 1914. Although it had an auspicious beginning, like Seeley, its growth has been slow.

Government Land Surveys

One of the most serious complications which confronted the early settlers in Imperial Valley was the inaccuracy of the Government land surveys. A large portion of the Valley lies between the Third and Fourth standards of parallel, the latter crossing the Valley only a few miles north of the international boundary. The area between these two parallels was supposed to have been surveyed in 1854-56. The area between the Fourth Standard of parallel and the international boundary was surveyed later, after the boundary line between the

United States and Mexico had been marked with permanent monuments by the International Boundary Commission.

In 1900, the C. D. Company, through the Imperial Land Company, commenced to rerun the Government lines and establish corners, in order to have the proper descriptions of the lands which the settlers wished to file on and for location of the canal system in the Valley. Large errors were found in the Government surveys. In a north and south direction, these errors proved to be as much as 1-1/4 miles in 24, and in an east and west direction approximated 2 miles in 30. It is reported that in an area of thirty townships, only five corners were discovered which appeared to be authentic. There seems to be little doubt but that the surveys were made on paper only and not actually run in the field.

It was not until July, 1902 that Congress passed an act authorizing a resurvey in Imperial Valley, and it was more than six years later before the work was completed and approved.

In the meantime, thousands of settlers had filed upon the land, but because of the fraudulent land surveys, it was impossible for the Land Office to issue patents; hence the settlers could not use the land as security for loans with which to make improvements and purchase water stock. This situation created a most severe handicap, not just to the settlers in the Valley but to the C.D. Company as well. The effects of the inaccurate survey have been a continuous source of difficulty in connection with titles to properties in the Valley, even up to the present time.

Government Soil Surveys

Early in 1902, the development of Imperial Valley received what was almost a fatal blow as the result of a report on a soil survey made by the United States Department of Agriculture. The report, known as Circular No. 9, was issued January 10, 1902, being based on a survey made in the fall of 1901 covering something over 100,000 acres in the southerly part of Imperial Valley. The report was very critical as to the value of the land for agricultural purposes. Since by that time there had been much publicity regarding the development of the Valley, the report was widely commented on by the press. In fact, the press went even further in condemning the Valley than was justified by the report itself.

The report stated that much of the land which had been examined contained too much alkali to permit growing ordinary crops. It stated that 125,000 acres of land had already been taken up by prospective settlers "many of whom talk of planting crops which it will be absolutely impossible to grow. They must early find that it is useless to attempt their growth." According to the report, only about 32,000 acres of the area surveyed was of sufficient agricultural value to warrant development.

In 1903, the Government extended the soil survey to cover most of the land on the floor of the Valley. This new report did not go quite as far as the earlier one in condemning the project. While it stated that the acreage of relatively good land was sufficient to make the Valley "quite a wealthy agricultural district," it was estimated that something less than 300,000 acres would justify development and inclusion within the irrigation system.

The impact of these two reports and the stories about them in the press was most serious and had a very depressing effect upon the credit of the settlers and that of the C. D. Company. There seems to be little question but that had there not been a large area already settled, with several thousand acres producing very good crops, the project would have been abandoned. However, development did proceed, and in 1954 the agricultural production from the 450,000 acres under cultivation in Imperial Valley had a value of $138,000,000.

United States Reclamation Service

Added to the many other complications and difficulties of the first few years of development was the agitation for the Government to take over the project. The Reclamation Act was approved in June 1902, and the Reclamation Service organized under that Act. The Imperial Valley project offered a major opportunity to the new Service. It also cannot be denied that there was considerable dissatisfaction among some of the settlers in the Valley with the C. D. Company. But how much of the agitation for a Government project in Imperial Valley was stirred up by representatives of the Reclamation Service and how much by local interests is not clear. In any event, in 1903 certain groups in the Valley started to advocate having the Reclamation Service take over the C. D. Company and complete the irrigation system.

Even prior to the organization of the Reclamation Service, the U. S. Geological Survey had started investigations on the lower Colorado River below Needles, looking into possible locations for dams and reclamation projects. After organization of the Reclamation Service, one of the first projects it recommended was the Yuma Project, including the construction of a dam (Laguna Dam) at the Potholes site. The Laguna Dam was known to be costly, and if charged only to the rather small Yuma Project, it would be much less feasible than if the large area of lands in Imperial Valley were also to be served from the Dam. It appears that the first intention was to do this; otherwise there was no reason for the Government's filing on 6,000 second-feet of water to be diverted at the California end of Laguna Dam.

In addition to dissatisfaction with the C. D. Company, the settlers in the Valley seemed to have the idea that their water would cost them much less if the Government took over the project; also, that there was some question as to the validity of the water rights of the C. D. Company which would be eliminated if the Government took over.

In 1904 a group of the settlers who were promoting the Government project idea organized the Imperial Water Users Association and negotiated with C. D. Company on the matter of a price which the latter would accept for its properties. The price agreed on was $3,000,000, and this was submitted to the Reclamation Service.

In this connection, the Fourth Annual Report of the U. S. Reclamation Service, 1904-05, states:

> "During the summer of 1904 the water users of the Imperial Valley requested the officers of the Reclamation Service to consider the purchase of the works of the California Development Company, and to complete the system under the reclamation act. This request was based upon a tentative agreement made between the water users and the California Development

> Company, providing for the sale of the properties of the California Development Company for $3,000,000, a portion of the water users agreeing informally that the purchase price and the cost of completing the system should be borne by the lands of the Valley.

A map of the locality, included in this Fourth Annual Report, shows the then existing canal system and also a proposed All-American Canal from Laguna Dam to the Valley, including a long tunnel to the north of Pilot Knob and under the sand dunes. Apparently the estimates of cost of the All-American Canal line appeared too great at that time to justify serious consideration.

The Reclamation Service continued investigations of the project during the summer and fall of 1904 and recommended to the Secretary of the Interior against accepting the proposed price for the property and rights of the C. D. Company as not being justified.

There were further negotiations between the water users, the C. D. Company, and the Federal Government which ended in failure and rather strained relations between the various groups.

In a further report, the Director of the Reclamation Service, on January 4, 1905, advised the Secretary of the Interior that the success of the project was in serious doubt and it was questionable that the United States should become involved in what he termed "the present desperate situation," also that "much of the land filed on is unsuitable for cultivation owing to the large amount of alkali and other adverse conditions of the soil," and that if the Government were to take over the project "it must make enormous expenditures at once to prevent the country from lapsing into desert conditions." Here again is evidence of the effect of the unjustified soil survey of 1901 and 1903 of the U. S. Department of Agriculture.

All consideration of the proposal was dropped when the Attorney General ruled that there was no existing law under which the Reclamation Service could take over the properties in Mexico. In this connection, the Fourth Annual Report of the Reclamation Service states: "The question of the United States acquiring the canal system (of the C. D. Company) by purchase, to be completed under the reclamation act, was later considered by the officers of the Reclamation Service. This purchase was strongly urged by many of the water users and settlers of the valley. The offer to sell the property was not considered, because the Attorney-General held that the international features of the project were prohibitory under the law, and the price asked was also considered excessive."

The aftermath of the matter was rather serious. The water users' dissatisfaction with the C. D. Company had now developed into strong antagonism. Also, the criticism of the project by the Reclamation Service and the attack on the water rights of the Company, which will be discussed later, so injured the credit and standing of the project among financial institutions in Southern California that at the end of the negotiations the Company was in a desperate financial situation.

Before leaving this subject, it is interesting to note the change in the attitude of the Federal Government within a very few years, as evidenced by the message of President Roosevelt to the Congress under date of January 12, 1907,

concerning the dangers to the Valley and other works on the lower River from the break of the River into Imperial Valley. In telling what would happen if the break were not closed, the President stated: "The great Yuma bridge will go out, and approximately 700,000 acres of land as fertile as the Nile Valley will be left in a desert condition. -- The entire irrigable area which will be either submerged or deprived of water in the Imperial Valley and along the Colorado River is capable of adding to the permanent population of Arizona and California at least 350,000 population, and probably 500,000. Much of the land will be worth from $500 to $1,500 an acre to individual owners, or a total of from $350,000,000 to $700,000,000." From the records, it is indicated that the material used in President Roosevelt's message was supplied by the Director of the Reclamation Service, the same man who had so greatly depreciated the Imperial Valley project in 1905.

Water Rights Questioned

As has been mentioned, the agitation for the Reclamation Service to take over the project included an attack on the water rights of the C. D. Company. This was on the basis that, since the Colorado River was considered to be navigable, no water rights could be established except upon approval by the Congress. Quite suddenly, the navigability of the River assumed much importance, even though, as a matter of actuality, navigation had practically ceased and has never been resumed.

When this question came up, the C. D. Company, to learn the attitude of the Secretary of War, requested permission to divert water from the River at Hanlon Heading. Replying under date of January 11, 1903, the Secretary of War submitted a report from the Chief of Engineers, U. S. Army, which, in effect, recommended "that no formal permission be granted, but that the company be informed that the War Department will not interfere with its operations, provided such operations are so conducted as not to injuriously affect the interests of navigation."

In January 1904, a bill was introduced in the Congress at the request of the C. D. Company which provided that the waters of the Colorado River were more valuable, and would be of greater public use and benefit, for irrigation than for navigation, and legalized the diversion of water which had been or would in the future be made for irrigation purposes under the laws of the States and Territories in which the diversion is made. The bill was opposed by the Interior Department on the basis that the United States should develop the River. It was also opposed by the Attorney General, who questioned the "wisdom of a surrender by Congress at this time of all control of the waters of the Colorado River," because of the provisions of the treaties with Mexico, and the irrigation projects to be built by the United States Government.

Pursuant to the request of the Committee on Irrigation of Arid Lands (to which the bill had been referred) for the views of the Interior Department, the Director of the Reclamation Service reported, through the Secretary of the Interior, under date of September 24, 1904, that control of the waters of the River by the Government was absolutely necessary to obtain the best results; that, the River being navigable, water appropriations under State laws were not valid; and that legislation should be enacted protecting present navigation interests, confining diversions heretofore, made to the amount of water put to actual beneficial use, making such water appurtenant to specified tracts of land, and further making the approval of the Secretary of the Interior necessary

in respect to future appropriations. No such legislation was then or has since been enacted by the Congress.

Whether the attempt by the Reclamation Service to discredit the water rights of the C. D. Company was to force the Company to turn over its properties and rights under terms acceptable to the Reclamation Service, or to exclude everyone but the Reclamation Service from developing the lower River is not known.

That the real reason for the attack on the water rights of the C. D. Company was not to protect navigation is evidenced by the fact that at that time the Reclamation Service had under consideration the construction of three storage dams below Needles and also had plans for the Yuma Project, including the construction of Laguna Dam, with no provisions whatever included for navigation.

If State laws did not apply and, under the guise of navigation, the Federal Government had complete control, then it may be asked why several water filings in the name of the United States were made under State law. These included a filing on October 21, 1903, by E. T. Perkins on behalf of the Secretary of the Interior, for 100,000 cubic feet per second of "unappropriated" water of the Colorado River at Headgate Rock; another filing on August 20, 1903, by E. T. Perkins on behalf of the Secretary of the Interior for 100,000 cubic feet per second of "unappropriated" water on or near Section 18, T. 6 S., R. 21 W.; a filing under date of July 8, 1903, for 3,000 cubic feet per second made by J. B. Lippincott on behalf of the United States, from the left (Arizona) side of the River at Laguna Dam; and another filing under date of July 8, 1905, also made by J. B. Lippincott on behalf of the United States, for 6,000 cubic feet per second from the right (California) bank of the River at Laguna Dam.

It should be further pointed out that the water filings of Thomas H. Blythe commencing in July 1877, made under State law were never questioned, nor were the numerous filings made under State law in the vicinity of Yuma for use in the Yuma Valley of Arizona, a number of which were later purchased by the Federal Government in connection with the Yuma Project.

It may also be noted that President Roosevelt's message of January 12, 1907, to the Congress, already referred to, telling of the wonderful possibilities of irrigation development on the lower River, made no reference whatever to navigation nor did it question the water rights of Imperial Valley.

Of course in later years, in the contracts with Imperial Irrigation District for surveys of an All-American Canal and for its right to divert at Laguna Dam, and also through the approval by Congress of the Colorado River Compact, the enactment of the Boulder Canyon Project Act, and by the water delivery contracts which have been entered into pursuant to the Act, all of these filings under State law have been recognized. But at the time, the attack on the water rights of the C. D. Company had a most disastrous effect upon the credit of the Company in its efforts to finance its activities.

Developments in Lower (Baja) California, Mexico

In the early years, there was very little development of lands in Lower California; only a few thousand acres was being irrigated when the River break of 1905-07 occurred, and this stopped expansion for a number of years. As of 1907, it is estimated that not over 5,000 acres was being irrigated.

A small settlement known as Algodones, located on the River at the international boundary line, had been in existence for many years. The town of Mexicali was laid out at about the same time as Calexico and had a small population consisting mainly of those connected with the construction of canals in Mexico.

VI. THE 1905 RIVER BREAK AND AFTERMATH

Diversion Difficulties

Intake Silting

Up to the time the C. D. Company commenced construction of its irrigation works, there had been but little experience in the handling of the heavily silt-laden waters of the Colorado River. In percentage of silt, the Colorado River has one of the greatest silt contents of any river in the world. While a large part of the silt is quite fine and remains in suspension at relatively low velocities, there is a considerable quantity of very heavy sandy material which is carried along or near the bottom of the stream; this is termed the "bedload". The largest amount of bedload is transported by the River during the flood season and was the material which gave particular difficulty at the heading of the new canal system.

As has been mentioned, there was an open intake channel about one-half mile in length above the Chaffey Gate. During the flood season, this channel would accumulate bedload brought in from the River. Then following the flood season, the increased elevation of the bed of the intake channel, due to this heavy silt deposit, made it difficult, during low stages of river flow, to divert sufficient water to meet irrigation demands. The diversion problem was further complicated by the fact that, as already mentioned, the sill of Chaffey Gate was perhaps not as low as it should have been and there was difficulty with the canal silting up downstream from the Gate. As a consequence, water shortages occurred during the winters of 1902-03 and 1903-04.

New Intake Channels

Even in 1901, it was apparent that the long intake channel could not be maintained properly; hence in 1902, a new and much shorter intake channel was excavated from Chaffey Gate to the River, but the silting problem continued even with the shorter channel. During the winters of both 1902-03 and 1903-04, a by-pass was cut around the Chaffey Gate in an effort to increase diversions to meet the irrigation demand. Also, in the early part of 1904, a third intake channel was temporarily opened from the River to the Alamo Canal immediately south of the international boundary line in Mexico. To add to these difficulties, by the end of the flood season of 1904, the upper end of the canal had become badly silted for a distance of about four miles into Mexico, and the situation was very critical.

Lower Mexican Intake

Reasons for Construction

With the equipment available at that time, together with the financial difficulties of the C. D. Company, there was serious question as to whether the canal could be cleaned in time to prevent another serious shortage in the following winter. The Company had attempted to sluice this silted section of the canal through a waste gate constructed about eight miles below the intake in March, 1904. It had been hoped that by diverting surplus water during the flood

season of 1904 and wasting it through the new gate back into the River, the upper section of the canal would be scoured out. However, following the 1904 flood season, it was found that the bottom of the canal was higher than it had been the previous year.

It was in the face of these conditions and the damage claims due to the water shortage of the previous year, already referred to, that the decision was made to make another connection between the canal and the River. The point selected was in Mexico below the silted four-mile section of the canal, where the canal turned westward away from the River.

At this point, a channel 60 feet in width was opened up for a distance of some 3,300 feet from the canal to the River, being completed in October, 1904. It was considered to be temporary only, the plan being to close it prior to the next flood season.

No Control Structure

No control gate was built for several reasons. In the first place, there was no anticipation of any difficulty in closing the channel before the next flood season. This was based on the fact that with the other diversion channels, the difficulty encountered had been in keeping them open sufficiently to divert the amount of water required, rather than in closing them. In the second place, approval of the Mexican Government for making this diversion had not been secured, and no head gate could have been constructed until the plans for such had been submitted to and approved by that Government.

The Break

First Closure Attempts

By reason of the rather limited experience at that time with the vagaries of the Colorado River and the lack of adequate records of flow, the extent of possible winter floods was not realized. There were five different floods during the winter of 1904-05. The first two floods did not enlarge the intake channel; in fact, it is reported that there was some deposit of silt, requiring dredging to maintain sufficient flow. But the third flood, coming in March, 1905, caused alarm and it was decided to close the intake channel as the main flood season was approaching.

The method used was the same as had been employed in closing the by-passes around Chaffey Gate and the other heading just below the international boundary line in Mexico, by the use of brush mats and backfill.

Control Lost

But another flood destroyed the closure work and further enlarged the intake channel. A new effort was made to close the channel, but again the work was swept away, by the fifth flood of the winter season.

With the increased flow in the River, it was realized that further attempts to close the break would be useless until after the passing of the flood season. By this time, the intake channel had been widened to about 150 feet, and after the 1905 flood season it had widened and deepened to such an extent that practical-

ly the entire flow of the River was passing into the Alamo Canal and down into Imperial Valley. During the following winter, additional attempts were made to close the break, by various methods such as jetties and brush dams, but all such were unsuccessful.

Following the flood season of 1906, it was found that the flow into the Alamo Canal had lowered the River bottom at the diversion point between 2 and 3 feet and had widened the intake channel to 2,700 feet.

Work was again resumed on attempts to close the break. A large wooden head gate was constructed in a by-pass channel, the gate being some 200 feet in length, it being planned to divert the water through this gate during the low flow of the River and then to throw a dam across the main intake channel.

In the latter part of August the work of damming the main intake channel to force the water through the head gate was started, but the gate failed on October 11, due to the floating of the central section, and proved to be a total loss.

The Second Break

The next attempt to close the break was successful. It was accomplished by driving parallel trestles across the break, connecting to upstream and downstream levees along the River, and from these trestles large quantities of rock were dumped until the flow through the intake channel was stopped. The closure was effected November 4, 1906, and the River was again flowing to the Gulf.

But success was short-lived. On December 5, 1906, a severe flood out of the Gila River broke the levee in several places downstream from the newly completed dam, and within twenty-four hours the River had been rediverted into the Alamo Canal.

Southern Pacific Company

Due to the financial conditon of the C. D. Company, the Southern Pacific Company, almost since the start of the break, had advanced the funds used by the C. D. Company in the various attempts to close the break. In fact, in connection with a loan made to the C. D. Company in the early part of 1905, the Southern Pacific had taken over control of the C. D. Company in June of that year.

The disaster of the second break, which occurred on December 5, 1906, made it very apparent that large additional sums of money would be required to close it and to construct levees which would prevent a repetition of the diversion of the River into Imperial Valley. By this time, the Southern Pacific Company was doubtful that the irrigation intersts could ever repay the monies the Company had already advanced in closing the first break and was convinced that there would be no possibility whatsoever of recovering any further advances. For this reason, the Southern Pacific notified the people of Imperial Valley that it would not advance additional funds until definite arrangements had been made for reimbursement.

Second Closure Successful

As a result, appeals were made by the people of Imperial Valley for assistance. Numerous civic and political bodies and officials of California wired

President Roosevelt asking that the Federal Government act in the emergency.

The President responded by making a personal appeal to President Harriman of the Southern Pacific Company, in an exchange of telegrams on December 19, and 20, 1906, asking him to proceed with the work and, it is claimed, assuring him that the Company would be reimbursed for such additional expenditures as it might make. Based on this assurance, Mr. Harriman, on December 20, ordered the work of closing the second break to proceed. The same methods were used as had been employed in the first closure, and the rock dam effecting the second closure was completed February 10, 1907.

These two closures constituted a tremendous undertaking and would not have been possible without resources such as were made available by the Southern Pacific Company. In supplying the great quantities of rock and gravel required, quarries as much as 150 and 200 miles away were utilized, and the rock trains were give the right of way over all other traffic on the railroad. Too much credit cannot be given the Southern Pacific and its engineers for the work which they accomplished.

Failure to Reimburse Southern Pacific Company

Early in 1907, a bill was introduced in the Congress to reimburse the Southern Pacific in the amount "paid by it from December first, nineteeen hundred and six, to November thirtieth, nineteen hundred and seven, in closing and controlling the break in the Colorado River and thereby saving the overflow and destruction of the Imperial Valley in southern California". It will be noted that the bill provided for reimbursement for only the final closure of the break; the previous attempts, including the closure of November 4, 1906, were charged to the C. D. Company.

Even though President Roosevelt recommended to the Congress that, as an act of justice, the United States should deal generously with the Southern Pacific Company in the matter for its prompt and effective work, which could in no other way have been done, the bill failed to pass. However, as a result of an agreement between the Committee which had considered the bill and the Southern Pacific Company, Mr. C. E. Grunsky, who had been a consulting engineer to the Secretary of the Interior, was appointed to determine the costs incurred by the Company which might fairly be considered as resulting from the request of President Roosevelt.

Mr. Grunsky reported that the total net expenditures of the Company between December 7, 1906, and July 21, 1907, chargeable to the closuer of the break amounted to $1,083,673.97, exclusive of interest.

Southern Pacific Company Paid

In the next session of the Congress, another bill was introduced to reimburse the Southern Pacific Company in the amount of $773,647.25, or about 70 per cent of that recommended by Mr. Grunsky. The bill passed the Senate but failed of action in the House.

No further action was taken until in 1926 when the Congress gave jurisdiction to the Court of Claims to determine the amount expended in closing the break. The Court gave its decision in 1929, fixing the amount due the Company at $1,012,665.17. It will be noted that this is very close to the amount recommended by Mr. Grunsky in 1908. The Congress authorized the payment of the judgment in 1930, and it was

completed in March of that year.

Complications With Work in Mexico

One of the complicating factors in connection with all work carried on in Mexico was that neither the C. D. Company nor the Southern Pacific Company, as such, could do any work in Mexico under their own names. At a later date, the U. S. Federal Government ran into a similar complication when it undertook to construct river levees in Mexico. It was therefore necessary that the work in connection with the canal system and the closing of the break be carried on in the name of La Sociedad de Yrrigation y Terrenos de la Baja California, S. A., the Mexican Company, with funds advanced by the C. D. Company or the Southern Pacific Company.

Damages from the Break

Erosion of New and Alamo Rivers

During the break, the large flow of water through the Alamo Canal caused an overflow for many miles and created a very serious situation. The larger part of the water overflowed the south bank and collected in New River channel in Lower California and thence passed down the west side of Imperial Valley to Salton Sea. At the closure of the Break, New River, which had been a rather shallow channel, had become a gorge 40 to 60 feet deep through Imperial Valley and extending for some six or eight miles into Lower California.

It was possible, through the use of the Alamo Wasteway at Sharp's Heading, to control the flow at that point during the River break, so that most of the area in the Valley east of New River received a continuous water supply. However, the large amounts of water which, to maintain control at Sharp's Heading, had to be wasted through the Alamo Wasteway to the Alamo River and thence to Salton Sea widened the River and deepened it as much as 20 to 30 feet in some places; but the resulting channel was small compared to that of New River.

It is estimated that some 13,000 acres of irrigable land, part of which was in crop, was destroyed by the erosion of the Alamo and New Rivers.

Salton Sea

Salton Sea, which had been practically dry, reached an elevation of approximately 195 feet below sea level by the time the break was closed in February, 1907. The surface area of the Sea at that time was about 500 square miles, (285,000 acres) with a length of 50 miles and a width of some 10 to 15 miles.

Flumes Over New River

In addition to the damage caused to the Alamo Canal, the water from the break destroyed the wooden flume which carried the Encina (West Side Main) Canal across New River in Mexico, and a similar flume across New River some 20 miles to the north of the international boundary line which supplied No. 8 Water Company.

Inasmuch as it was not practical to rebuild the No. 8 flume because of the greatly increased width and depth of the New River channel in that locality created by the flood, it was decided to enlarge the West Side Main Canal in Mexico and

extend it north from the international boundary to serve all of the area west of New River. This was done in 1907, including the building of a new enlarged wooden flume across New River in Mexico, with a length of some 1,860 feet and a capacity of 1,200 second-feet.

Loss of Crops

The most serious injury from the flood waters to the developed area of the Valley was the cutting off of the water supply for Water Companies Nos. 6 and 8, resulting from the destruction of the two flumes over New River already referred to. Some 30,000 acres were involved, of which 12,000 acres were in cultivation. All crops on these lands were lost, and the people living in the area had to move out until water service was restored.

Until the major recession occurred in New River, the west side of the Valley was virtually one big lake, overflow being kept from the east side only by intensive work on the westerly bank of the Brawley (Central) Main Canal. It appeared for a time that this bank could not be held and that a large part of the easterly side of the Valley would also be under water, but with the recession of New River, the lake was drained and the threat to the east side of the Valley removed.

Railroad Lines

Due to the tremendous rise in Salton Sea during the break, the main line of the Southern Pacific through that area had to be shifted to higher ground several times. In addition, the branch line to Calexico was washed out where it crossed the Alamo and New Rivers north of Brawley, and there was considerable damage in the vicinity of Calexico and Mexicali where the line had to be relocated, due to the New River gorge engulfing the southwest corner of Calexico and the northwesterly part of Mexicali. The total damage sustained by the Southern Pacific Company on its railroads alone was estimated to be $870,000.

New Liverpool Salt Company

For some years prior to the break, the New Liverpool Salt Company had beem harvesting salt from the bed of Salton Sea near its northerly end. These works were, of course, entirely submerged by the Sea prior to the closure of the break, and that Company obtained a judgment for damages against the C. D. Company, which will be discussed at a later point.

Benefits from Break

Although the River break caused extensive damages to the physical properties and, largely through fear of a possible repetition, to the financial credit of the Valley, there were also some benefits.

The deeply eroded New River and Alamo River channels through the Valley became the main drainage outlets to Salton Sea for the extensive drainage system which was later to be constructed, as well as for the disposal of waste and sewage from the cities and towns.

Those who had studied the delta agree that had not the 1905 break occurred as it did, conditions on the River were such that a natural diversion in the

same vicinity, to the west into Imperial Valley, was imminent at the time. As a matter of fact, such a natural diversion did occur in 1908-09 about twenty miles downstream at a point in the River about opposite the lower (Arizona - Mexico) international boundary line. The end had come to the peaceful meandering of the River along the east side of its delta in Mexico, which had existed over the previous five hundred years. While the 1905 break was a bitter and costly experience, still the knowledge gained from it and the realization of the need for a levee system, perhaps saved Imperial Valley from a far worse disaster at a later time through the River diverting itself into the Valley.

Permanent Hanlon Heading

Original Structure

The loan of $200,000 made to the C. D. Company by the Southern Pacific Company in the early part of 1905 was primarily for the construction of permanent head works to replace the wooden Chaffey Gate and to construct the Alamo waste gate at Sharp's Heading. Work on the new head gate, known as Hanlon Heading, was started in December 1905 and completed in June 1906. The new structure was constructed on solid rock where a spur of Pilot Knob Mountain extended out near the River channel, the location of the structure being somewhat to the north and a short distance to the west of the Old Chaffey Gate. A new intake canal was excavated from the River to the new structure. Hanlon Heading had 11 gate openings each 12 feet wide and 10 feet high, the flow through them being controlled by radial gates. The designed capacity was 10,000 cubic feet per second at low-flow stages of the River, with the sill of the gate placed at a much lower elevation than that of the Chaffey Gate. There was also a "navigation pass" 10 feet 3 inches wide at the east end of the structure for the purpose of passing small power boats through the structure.

Addition to Hanlon Heading

In 1913, a "Stoney" gate was added to the west side of Hanlon Heading, occupying three of the original gate openings. This gate has a single opening of 25 feet by 14 feet, with the sill 5 feet lower than that of the main structure and was completed in May of that year. The purpose was to improve diversion conditions during low-flow periods of the River.

Repairs and Improvements to Canal System

Following the closure of the break, in addition to the rebuilding of the Encina (West Side Main) flume over New River and extension of that canal in the United States, other work was undertaken.

The banks of the Alamo Canal were repaired and strengthened and the work of straightening and confining the channel was commenced.

At a point on the Alamo River west of Holtville, a large concrete drop structure - known as Rositas Wasteway - was constructed to raise the water in the River for service to the Mesquite Lake area through the Rose Canal, for which a concrete head gate was also installed. In this way, reuse was made of the water discharged from the Holton Power Plant, as well as that which was passed through the Alamo Wasteway at Sharp's Heading in Mexico.

The Rositas Wasteway was designed for a capacity of 2,000 second-feet. The

drop at that time between the water surface above and below the structure was about 20 feet, but in later years, as recession developed in the Alamo River below the structure, a series of wooden step-drops had to be constructed downstream from the main structure, the over-all drop finally amounting to about 50 feet.

Recession in the Alamo River at Sharp's Heading also required the extension of the chute of the Alamo Wasteway. This structure also had a capacity of about 2,000 second-feet, and although of wood construction, no difficulties were experienced with a head of 35 to 40 feet.

Other minor concrete and wood structures were installed and several of the main canals enlarged in order to take care of increasing demands for water as development of the Valley proceeded.

Start of River Levee System

Prior to the break of the River into the Valley, no flood-control levees had been constructed along the River. It appears that the early developers had little if any realization of the danger of inundation of Imperial and Coachella Valleys by the Colorado River. It was generally thought that the bank along the River side of the canal would serve the purpose of protecting the canal itself from danger of flood waters getting into the canal, but beyond this no plans were made to keep the River from overflowing into Imperial Valley.

Another reason for lack of concern was that, although not realized at the time, drouth conditions over the Colorado River Basin had existed since the early nineties, and seasonal flood peaks had been exceptionally small. This meant that there had been but a relatively small amount of river-bank overflow during the flood seasons; hence conditions during a large flood had not been experienced. However, the break of the River brought realization of the necessity for an extensive levee system to protect the lands both in Lower California and in Imperial Valley. To this end, the C. D. Company commenced surveys for a levee system early in 1906.

The first levee had been built during the time of the break and extended along the River from the Chaffey Gate at the boundary, south into Mexico to a point some four or five miles past the break. Subsequently this levee was extended to a total length of about fifteen miles, the extension paralleling the River for three or four miles, then swinging to the southwest along the south bank of what was known as the Paredones River - another side channel of the main River which collected overflow during the flood season - which led in a southwesterly direction toward the Volcano Lake region. After the closure of the break, a standard-gage railroad was built on top of the levee and the River slope covered with gravel. At the upper end, the railroad was carried across the new Hanlon Heading structure and into the Andrade quarry. It was thereafter used in hauling the rock used on the levee system in Mexico. This was the start of what in later years became a very extensive levee system.

At that time, it was hoped that the American and Mexican Governments would take over the flood-protection work, in view of the recommendations of President Roosevelt in his message of July 12, 1907, to the Congress, heretofore referred to. Some help was later received from the American Government but none from the Mexican Government.

Other Events to 1909

Imperial Water Company No. 12

From the period of 1900-02 through 1909, only one additional mutual water company was organized. This was Imperial Water Company No. 12, organized in May 1908, with an area of about 16,000 acres, being located on the west side of the Valley between Water Company No. 6 and Water Company No. 8.

1909 River Diversion to Bee (Abejas) River

Reference has already been made to the fact that an epochal change in the course of the River seemed imminent at the turn of the century. The summer flood of 1907 was much larger than usual and a very great increase in the quantity of overflow water reaching the Volcano Lake area was noted in that year. A similar increase was noted during the flood season of 1908. It was also observed that fingers were being cut from the main channel of the River into several side channels.

This was particularly true as to one of the larger side channels known as Bee (Abejas) River, which originated near the main channel some twenty miles below the upper (California - Mexico) international boundary line. Although the danger to Imperial Valley from a diversion of the River to the west through Bee River was realized, no attempt was made to prevent such a diversion because of a lack of finances - the Southern Pacific Company was unwilling to advance further funds and no others were available.

The summer flood of 1909 (with a peak of about 150,000 second-feet) was the largest of record to that date. By the end of the flood season, the Colorado River had completely diverted itself into the Bee River, which it followed west and into the large flat area of Volcano Lake, putting this entire section of the delta under water.

It may be that this natural diversion of the River to a new course was hastened somewhat by the 1905 break and also by the completion of the Laguna Dam in 1909 by the Federal Government. The Dam created a reservoir which desilted the River, thus increasing its scouring capacity downstream. In any event, there is little doubt but that the Bee River diversion, or a similar one to the west, would have occurred within a few years.

While no attempt was then made to close the break from the main River into Bee River, the C. D. Company did throw up a small levee in 1908 from the high ground at the base of Cierro Prieto (Black Butte) northeasterly across New River and along the west rim of Volcano Lake for a distance of about eight miles. This became known as the Volcano Lake Levee and will be discussed further at a later point. The levee was constructed across lands of the Colorado River Land Company, which had purchased practically all of the remaining Andrade lands. As a condition to granting a right of way for the levee, the Company required that a diversion gate be constructed in the new levee through which the Company planned to take water to irrigate a portion of its lands lying to the west of the levee. However, the Mexican Government did not approve the installation of the gate, so a levee was built in front of it and the gate never used.

Again Imperial Valley was placed in grave danger of inundation by the River.

VII. FINANCIAL DIFFICULTIES AND RECEIVERSHIP

Control Taken by Southern Pacific Company

The loan of $200,000 from the Southern Pacific Company to the C. D. Company in 1905 has been referred to previously. As conditions to making the loan, the Southern Pacific required the C. D. Company to put up 6,300 shares of capital stock, to be held by a trustee until the loan was repaid, and permit the Southern Pacific to take over the management of the C. D. Company.

These terms were agreed to, and on June 20, 1905, officials of the Southern Pacific Company were named as officers of the C. D. Company and also of the Mexican Company.

It should be pointed out that at the time the loan was made, the conditions along the River were not considered serious. However, the subsequent cost of closing the break made it impossible for the C. D. Company to repay the loan, and the Southern Pacific Company retained virtual control of the C. D. Company and the Mexican Company until they were purchased by Imperial Irrigation District in 1916.

Claim of New Liverpool Salt Company

Reference has already been made to the New Liverpool Salt Company, which had been harvesting salt from the north end of Salton Sink for a number of years prior to the 1905 break. The first waters from the break reaching Salton Sea inundated the works, and in March, 1905 the Salt Company filed suit against the C. D. Company claiming damages in the amount of $180,000 for land and salt deposits and $30,000 for plant. When the Sea continued to rise and destruction became complete, the Salt Company increased the figures to $325,000 and $75,000 respectively.

The suit was decided by the Federal District Court in January 1908, with the Salt Company being awarded a total of $458,246.23, and the decision was later affirmed by the United States Supreme Court. There is little question but that the award was excessive. Moreover, it indicated that the C. D. Company would be held liable for all damages caused by the break of the River, regardless of the fact that not only was the diversion, which caused the break, made in a foreign country, but also, technically, by a foreign corporation.

Claims of the Southern Pacific Company

By the time closure of the break was completed, additions to the original $200,000 loan from the Southern Pacific to the C. D. Company had increased it to $1,100,000. In this connection, it should be pointed out that, in addition, the cost of the final closure - that is, between December 1906 and February 1907- was paid directly by the Southern Pacific Company and included in the amount for which reimbursement was requested from the United States Government. Other expenditures by the Southern Pacific Company had been made through and charged to the C. D. Company. As before-mentioned, all work in Mexico was actually done in the name of the Mexican Company but was paid for by the C. D. Company. Later bills and interest charged by the Southern Pacific Company against the

C. D. Company, by January 1, 1909, had increased the $1,100,000 to $1,375,000.

The Southern Pacific Company also brought suit in the United States Courts for damages to its properties in the United States, and in the Mexican Courts for damages both in Mexico and in the United States. The Mexican Courts rendered judgment for $900,000 gold against the Mexican Company and ordered enough of its properties sold to satisfy the judgment. The United States Courts awarded the Southern Pacific Company judgment for $1,500,000, but final settlement was not effected until Imperial Irrigation District purchased the C. D. Company in 1916.

Litigation with No. 5 Water Company

In August 1906, the C. D. Company commenced an action in the Unites States Circuit Court to compel Water Company No. 5 to pay up certain back water rentals which the Water Company had refused to pay, due in part to dissension between the two companies. In its cross complaint, the Water Company attacked the validity of the general arrangements between the C. D. Company and the water companies for obtaining a water right through the sale of water stock.

Although the Circuit Court held that the question was one to be decided by the State Courts of California, it offered its opinion that the plan was illegal and that, in effect, the C. D. Company was a public service corporation and should deliver water to users without regard to water stock.

The question was finally settled by the Supreme Court of California in the suit of Thayer vs. C. D. Company in its opinion rendered in 1912 in favor of the C. D. Company, which will be discussed at a later point. But in the meantime, the status of the entire plan of development was left in question.

Bankruptcy and Receivership

By the year 1909, the C. D. Company, to sum up its financial situation, was owing the Southern Pacific Company for advances, including interest, in the amount of $1,375,000; the judgment for over $458,000 in favor of the New Liverpool Salt Company was outstanding; and there were damage claims against it by the the Southern Pacific Company and others totalling $1,360,000. In addition, it had bonds outstanding which, with accrued interest, amounted to more than $500,000, and its Mexican Company had the judgment of $900,000 to face. There was little question but that the C. D. Company and the Mexican Company were bankrupt.

It was in view of this situation that on December 13, 1909, the Title Insurance and Trust Company, as trustee for the bonds of the C. D. Company, applied to the Superior Court of Imperial County asking that the C. D. Company be declared insolvent and that a Receiver be appointed, looking to the foreclosure of the properties of the C. D. Company. The application was granted the same day and Receivers appointed for both the C. D. Company and the Mexican Company.

At the time of the $500,000 bond issue of the C. D. Company in 1900, the Company, as security for the bonds, had issued a deed of trust to the Title Insurance and Trust Company, as trustee, covering all of its properties in the United States and had pledged to the trustee 12,000 shares of the stock of the Mexican Company. In addition, the Mexican Company, in 1902, had delivered to

the trustee a mortgage on all of its properties in Mexico. But neither the deed of trust nor the mortgage was recorded in Mexico, as required by the laws of that country. This was to cause serious difficulties before the foreclosure proceedings were finally decided by the Supreme Court of California.

The outcome of the case will be discussed in the next chapter.

VIII. DEVELOPMENTS DURING RECEIVERSHIP

Assignments to Southern Pacific Company

As has been previously mentioned, the Southern Pacific Company took over the control of both the C. D. Company and the Mexican Company in 1905. When it appeared from the Salt Company judgment that the C. D. Company would be held liable for all damages caused by the break, the Southern Pacific Company, as a measure to protect its loans to the C. D. Company, had assigned to it all of the personal property of the C. D. Company, the unsold water stock which the latter held, and also all future payments for water rentals until the loans to the C. D. Company had been repaid.

New Mexican Company

Mention has already been made of the judgment in the amount of $900,000 gold rendered by the Mexican Courts against the Mexican Company and the order that enough of the properties of the Mexican Company be sold to satisfy the judgment. The Mexican Company was also faced with additional suits pending in the Mexican Courts for damages resulting from the break, and its properties were already mortgaged in connection with the original bond issue of the C. D. Company. Still further complications were added with the appointment of a Receiver for the Mexican Company.

In view of this situation confronting the Mexican Company, the Southern Pacific interests organized a new corporation under the name of Compania de Terrenos y Aguas de la Baja California, Sociedad Anonima - hereinafter referred to as the New Mexican Company. It was incorporated on August 20, 1910, for a period of fifty years, with about the same objects as those of the original Mexican Company.

The Articles of Incorporation, or Charter, fixed the capital stock at $500,000 (pesos), made up of 5,000 shares having a value of $100 (pesos) each. Among other provisions, the Charter prohibited the Company from mortgaging or transferring to any Government, and also from admitting any Government or foreign State as a stockholder or allowing such to acquire any profits from the shares, properties, or rights of the Company, any contract or arrangement in violation of these provisions being null and void. Permission was obtained by the New Mexican Company from the Mexican Government to hold the concession of the original Mexican Company.

To satisfy the Southern Pacific's judgment of $900,000 against the original Mexican Company, a sale was held on January 28, 1911, at which the New Mexican Company bid in all of the real and personal property of the Mexican Company- which included the 1904 concession from the Mexican Government - for the sum of $325,000 gold, or about 36 per cent of the amount of the judgment.

The effect of this sale was to leave the old Mexican Company with a judgment against it of $575,000 gold and additional damage suits in the Mexican Courts toalling nearly $2,000,000, but with no property or assets whatever. In addition, the sale had the effect of freeing the New Mexican Company from any contracts with the C. D. Company or the mutual water companies, and it could have given the New Mexican Company complete domination of the development of

Imperial Valley.

Shortly after the sale, fraudulent dealing was alleged, and it was advertised on November 18, 1911, that the judge in Mexicali would hear any and all complaints regarding the sale, but no one appeared in protest. However, the New Mexican Company did not move at that time to take over the properties and the involved situation was not cleared up until the District purchased the C. D. Company and the two Mexican companies in 1916.

Diversion Weirs

1910 Weir

Although the installation of the permanent Hanlon Heading improved diversion conditions somewhat following the closing of the break, difficulties with the silting of the Intake Channel and the upper part of the Alamo Canal continued. During the flood season, the Intake Channel, which was about 1,900 feet in length, would silt up; then following the flood, as the level of the River would drop, efforts would be made to sluice enough of the sand from the Intake Channel down the Alamo Canal, so as to be able to divert the irrigation requirements. In this way, water shortages were averted until 1910.

The flood of 1909 - about 150,000 second-feet - was the largest experienced up to that time, and it was noted at the end of that year that the water surface in the River at the intake was much lower than it had been. This was attributed to two factors: first, the diversion of the River into the Bee River and Volcano Lake in 1908-09, which caused a recession in the River bed upstream from the diversion; and second, the effect of the completion of Laguna Dam in 1909. The Dam created a reservoir, which had the effect of desilting the River's flow; in fact, the reservoir was almost completely filled with silt within one year. This meant that below the Dam, the desilted waters scoured the River bed until normal conditions were returned.

The situation at the intake indicated that there would be difficulty in diverting sufficient water to meet the demands during the low-flow periods of 1910. As a result, request was made of the War Department for permission to build a temporary weir in the River immediately below the intake. This was granted in March 1910 on the condition that the obstruction would be of a temporary character. Construction of the weir was then started, but an increase in the River discharge made the weir unnecessary until after the summer flood was passed.

In July 1910, work was resumed on the weir. A trestle 960 feet in length was constructed across the River, starting immediately below the intake and at an angle of approximately 70 degrees, the Arizona end being upstream from the California end. A railroad was placed on top of the trestle, from which rock was dumped until the River level was raised about 2 ½ feet. As a result, the full demands for water were met.

In accordance with the permit, the trestle was destroyed by blasting down to the water line in March 1911, but no rock was removed. As a matter of fact, the floods of succeeding years caused no major change in the remaining rock weir, and it sufficed until 1915.

Diversion conditions were also helped by the use of two suction dredges,

one of which was placed in the Intake Channel between the River and Hanlon Heading and the other in the Alamo Canal below that Heading. These two dredges, by removing the sand from the bottom of the canal, made it possible to divert water at a lower River gage height than would otherwise have been possible.

1915 Weir

In 1915, it appeared that the stage of the River would be such as again to make it impossible to divert a sufficient amount of water to meet the greatly increased demand. Therefore, a small temporary brush weir was built on top of the remaining rock weir, commencing at the Arizona shore and extending partway to the California shore, which sufficed to meet diversion requirements during the low flow of the River in the winter of 1915-16. No permission for this work was requested of the War Department.

Additional River Levees

Negotiations with Mexico

Although international control of the protective work along the lower Colorado River had been recommended by President Roosevelt in 1907, little progress had been made toward reaching an agreement with Mexico.

In the spring of 1908, Lewis C. Hill, an engineer with the Reclamation Service, had been appointed by the State Department to represent the United States on a joint commission to work out provisions of a treaty with Mexico for the control of the lower Colorado River and an equitable distribution of its waters. At the request of our State Department, Mexico appointed its representative at about the same time. It was the intention of the Commission to study the situation on the lower River and the works necessary to bring about complete international control. The commission had one or two informal discussions but never a formal meeting. In May 1910, Mr. Wilbur Keblinger, Secretary of the American Section of the International Boundary Commission, was appointed to replace Mr. Hill on the commission. However, nothing further was accomplished, due in large part, no doubt, to the unstable political conditions through which Mexico was passing at that time.

Ockerson Levee

In 1909, diversion of the River into the Volcano Lake area caused considerable alarm among the people of Imperial Valley, who realized the great menace it created. Appeals were made to President Taft for assistance, and on his recommendation the Congress appropriated a million dollars in 1910 for protecting Imperial Valley from the Colorado River, the President being authorized to expend such amount of the money as might be required within Mexico "In accordance with such agreements for the purpose as he may make with the Republic of Mexico."

The Mexican Government would not permit official participation by the United States Government in the work in any form whatsoever. As a result, arrangements had to be made for carrying on the work in the name of a Mexican Company, for which purpose the Colorado River Land Company was selected, with the funds being made available to the Company by the United States and officers of the United States supervising the work, but only in their capacity as private citizens - a most unsatisfactory arrangement.

The appropriation was used to extend the existing levee - C. D. Levee - along the River for a distance of about twenty-five miles in Mexico, which carried it across and for several miles below the break of the old channel into Bee River, the new levee being named Ockerson Levee. The work was completed in May 1911, but floods a short time later breached the new levee at the Bee River break and at many other points. The result was an almost total loss of the work, and the River was again flowing through Bee River into the Volcano Lake area.

United States Government Withdraws

In 1912, a part of the unexpected funds remaining from the 1910 appropriation was used in repairing numerous breaks in the upstream section of the Ockerson Levee, and again the work had to be carried on in the name of the Colorado River Land Company. In 1913, the remainder of the 1910 appropriation was used in repairing a break in the C. D. Levee a few miles below the international boundary line in Mexico, to which cost $30,000 was contributed by Imperial Irrigation District.

By the start of 1915, the general situation as to flood control was chaotic. The C. D. Company and the Mexican Company were bankrupt and in the hands of Receivers with insufficient funds available, and Imperial Irrigation District was not yet in position to take over because of legal complications. In view of these conditions, a further appeal was made to the Congress for assistance, and the sum of $100,000 was appropriated in March of that year, with the provision that Imperial Irrigation District contribute a like amount, which it did. These funds were expended in raising, strengthening, and extending the Volcano Lake Levee about four miles, and in rock revetting the parts of the C. D. Levee then under attack by the River. This was the last expenditure of funds by the United States Government on flood-protection work for Imperial Valley; the people of the Valley were left to their own fate, being faced with a flood menace far more critical than had existed up to that time.

Additions and Betterments to the Canal System

Receiver's Certificates

When the Receiver for the C. D. Company took over in December 1909, he found there were no funds available with which to operate. To secure the necessary funds, he obtained an order from the Court to issue Receiver's Certificates, and to April 1918, $315,000 of such Certificates were sold at par to the Southern Pacific Company. This money, together with subsequent collections for water delivered to the mutual water companies, financed the operations of the Receiver.

Major Structures

Mention has already been made of the Stoney gate attached to Hanlon Heading, which was installed during the receivership. Other important canal structures built during this period included Cudahy Check, Laurence Heading (this was on the Alamo Canal in Mexico at the point of diversion for the new East Highline Canal), and a new head gate for the West Side Main (Encina) Canal at Sharp's Heading.

Due to a washout of the West Side Main Canal at the upstream end of the

flume over New River, it was necessary to replace the flume with a new structure located just above the old structure. The new flume, like the old one, was built of wood and was 22 feet wide, 6 feet deep, and had a capacity of 1,200 second-feet. Its length was about 700 feet, and it was connected to the canal at both ends by concrete structures.

East Highline Canal

Improvements to the canal system included completion of construction of the East Highline Canal in 1914 from the Alamo Canal at Laurence Heading in Mexico northward fifty miles to Niland, together with lateral turnouts, which provided service to some 110,000 acres on the easterly side of the Valley.

Alamo Canal

During the period following the closing of the 1905 River break, conditions in much of the Alamo Canal in Mexico became quite serious and went from bad to worse during the receivership. The old overflow channel of the River, which had been converted into the Alamo Canal, followed a very torturous course. In the original work, no serious attempt had been made to straighten it and only short stretches of low banks had been required, since the channel was at or below the level of the adjoining lands. The flood waters from the break not only overpoured the banks of the Alamo Canal, but brought in tremendous quantities of sandy silt from the River. As a consequence, the silted channel spread out over a considerable area and growth of vegetation was dense, creating swamp conditions.

In his book "Wonders of the Colorado Desert," James tells of a trip he made down the Alamo Canal in March 1906. For the first ten miles it was easy going, but below that point he spent days in forcing his boat through an almost jungle of vegetation and in trying to avoid sand bars and other obstacles. These conditions, with the continued inflow of heavy silt-sand from the River, caused a rapid rise in the water surface of the canal.

Some work was done during the receivership in cutting off bends and attempting to channelize the canal, but most of the effort was confined to building and raising the outside levees, and it was with great difficulty that those on the south side were maintained to a sufficient height.

Before this condition was brought under control by Imperial Irrigation District many years later, hundreds of thousands of dollars had been spent in channelizing the canal and confining it to a reasonable width so that a velocity could be maintained that would carry the heavy silt to points where sluiceways were available to remove some of it from the canals.

Miscellaneous

In addition to the work which has been mentioned, a number of minor canals and structures were installed in the United States and many of the larger canals were enlarged to take care of the rapidly increasing demand for water. By 1915, there were some 400,000 acres of land being irrigated in Imperial Valley and about 40,000 acres in Lower California.

Thayer vs. California Development Company

To the confusion and legal complications which existed when the receivers were appointed was added the law suit of Thayer vs. C. D. Company and W. H. Holabird, as Receiver for the Company. The suit was brought in the Superior Court of Imperial County in December 1910 as a procedure in mandamus to compel the Receiver to deliver water to a landowner who held no water stock, the contention being that the C. D. Company was, in effect, a public utility and had to provide service to whoever requested it within the Company's territory. This suit, in effect, attacked the legality of the entire plan of development, including the Tri-Party Contracts and the financing of the construction of the canal system through the sale of water stock of the mutual water companies.

The decision of the lower Court, rendered in March 1911, held that the C. D. Company was a public utility, that the charge for supplying water was 50 cents per acre-foot, that the Company could without detriment to other water users serve the land of the plaintiff, and ordered it to do so. The decision was appealed to the Supreme Court of California, which rendered its opinion in the latter part of 1912, under which the decision of the lower Court was reversed. The Supreme Court held that the C. D. Company was not a public utility, that its method of procedure was legal and proper, and that delivery to the land of the plaintiff was not required unless and until such land was covered by water stock.

Until reversed by the Supreme Court, the decision of the lower Court was another disturbing factor in the operations and financing of the C. D. Company.

Additional Mutual Water Companies

During the period of the receivership, a number of additional water companies were organized. These included the South Side Water Company, with 18,500 acres; the East Side Water Company, with 4,200 acres; and the South Alamo Water Company, with 1,900 acres, all of which were organized in 1912. In 1913, No. 2 Water Company, with 7,500 acres, and No. 3 Water Company, with 53,000 acres, were organized.

This completes the list of all the mutual water companies, except the New River Water Company, with 1,410 acres, organized in 1917, and No. 9 Water Company, with 21,000 acres, organized in 1919.

No. 9 Water Company included land between the Alamo and New Rivers to the west of Calipatria and received water service by a concrete check structure, known as North End Dam, which it constructed in the Alamo River at the head of its main canal. Originally the drop in water surface in the Alamo River at the structure was about 9 or 10 feet, but subsequent recession in the River downstream increased it to about 18 feet.

Organization of Imperial Irrigation District

As has been noted, there were troubles between the various mutual water companies and the C. D. Company almost from the start of development. These were increased by the agitation to have the Reclamation Service take over the project and were further added to by unsatisfactory water service which continued after the appointment of the Receivers.

From the day of their appointment, there was disagreement between the two Receivers. Mention has already been made of the shortage of funds to carry on needed work. This led to disputes over what part each was to receive from monies collected from water sales. Also, the litigation over damage claims and the resulting judgments against the C. D. Company and the Mexican Company added to the dissension.

Because of the unsatisfactory situation created by all of the foregoing, leaders in Imperial Valley realized, when the Title Insurance and Trust Company brought its suit to foreclose on the properties of the C. D. Company and the Mexican Company, that something had to be done or great harm could result to Imperial Valley and its people. They were aware of the possibility of a sale, under the foreclosure proceedings, of the C. D. Company and the Mexican Company to different controlling interests, which would make the question not only of water supply, but of the price which might have to be paid for service, a critical matter. Also, there was the legal question as to the validity of the contractual relationship between the C. D. Company and the mutual water companies raised by the suit of August, 1906 brought by the former against No. 5 Company and which was attacked again in the case of Thayer vs. Water Company No. 1, commenced in December, 1910. Moreover, none of the thirteen water companies was in a position to cope with the situation confronting the Valley as a whole. For these and many other reasons, it was decided to organize an irrigation district in Imperial Valley which would include the area of all the mutual water companies.

By a decisive favorable vote at an election held July 14, 1911, the people of the Valley organized Imperial Irrigation District. It was made effective by resolution of the Board of Supervisors of Imperial County on July 24, 1911. The District was organized under the California Irrigation District Act for the purpose of acquiring the rights and properties of the C. D. Company and its two Mexican companies. At the time, absorption of the mutual water companies by the District was not made an issue, although there was some discussion of it.

As organized, the district included 513,368 acres within its boundaries,an area some 65,000 acres in addition to that covered by water stock of the mutual water companies.

Problems Confronting District

The organization of Imperial Irrigation District did not immediately clear up the many problems confronting the Valley - in fact, a few new ones were created. At the time the first assessment was levied by the District Directors, the validity of the formation of the District was taken to court by an attack on the validity of the assessment. The decision of the Court upholding the validity of the assessment, in effect, confirmed the legality of the formation of the District.

Another problem was, that under existing California law, the District could not own property in a foreign country; this situation was corrected by a constitutional amendment adopted by the Sate Legislature in 1913 and ratified by the voters of the State at the general election in 1914.

The most serious problem was that of settling the complicated litigation involving the C. D. Company and the two Mexican companies and their creditors, which had been before the Courts for a number of years. The claims and judgments

which had to be settled included the following:

Outstanding Receiver's Certificates	$ 315,000
Ttile Insurance and Trust Company, for bonds of C. D. Company and interest	634,211
New Liverpool Salt Company	458,246
Southern Pacific Company	1,501,903

Interest and other charges increased the total to in excess of $3,000,000, to which, as an offset, could be credited some cash on hand with the Receiver and water rental payments owed by the mutual water companies. These claims had been confirmed by decision of the Superior Court on January 4, 1913 (Title Insurance and Trust Company vs. C. D. Company), and although the case had been appealed to the Supreme Court, it was felt that the latter would make no substantial changes.

It was also realized that upon taking over the properties, funds would have to be provided for extensive improvements and repairs to the canal system, as well as for work on the protective levee system along the Colorado River in Mexico. It had become apparent by this time that the United States Government was unlikely to provide additional funds for such protective works.

First Bond Issue of District - 1915

To provide funds for all of the aforementioned purposes, the District voted a bond issue of $3,500,000 in October, 1914 of which $3,000,000 was to be used in the purchase of the properties of the C. D. Company and the Mexican Companies and $500,000 was to be used for improvements to the canal and levee systems.

District Takes Over

Agreement with Southern Pacific Company

During this time, extensive negotiations were carried on between the District and the Southern Pacific Company, which not only had control of the C. D. Company and the Mexican Companies, but also was the main creditor of those Companies. A plan was agreed on whereby the Southern Pacific Company would purchase in its own name the C. D. Company and the two Mexican Companies, and then in turn sell the properties to the District. The terms of the transaction were incorporated in an agreement dated February 8, 1915, between the District and the Southern Pacific Company, which was modified in minor details following the final judgment in the Title Insurance and Trust Company case, hereinafter discussed, by an agreement between the parties dated December 28, 1915.

The agreement provided that at the foreclosure sale to be held in accordance with the decree in the case of the Title Insurance and Trust Company vs. the C. D. Company, the Southern Pacific would submit an offer to purchase the properties of the C. D. Company and its Mexican Companies for such amount as would be necessary to acquire the title thereto, but the purchase price offered was not to exceed the total amount of the judgments against the Companies. In the event the Southern Pacific Company acquired title to the properties at the foreclosure sale, it would in turn sell such properties to the District for $3,000,000, but there was to be excepted and reserved from such sale to the District, title to all of

the land in Lower California held by the Mexican Companies (this amounted to some 70,000 acres, being the remainder of the 100,000-acre tract originally purchased by the Mexican Company), except for land required for rights of way for canals and appurtenances. The agreement also contained provisions for granting a flooding easement to the District in connection with Southern Pacific lands around Salton Sea, fixing a limitation on the height to which the Sea might be allowed to rise in the future.

The agreement further provided that the $3,000,000 bond issue of the District would be dated January 1, 1915, the bonds to bear interest at the rate of 5 per cent per annum, and fixed the conditions under which the Southern Pacific Company would accept the bonds at par in payment of the purchase price of properties. The Company was to receive interest on $2,152,500 of the bonds from July 1, 1915, and on $847,500 of the bonds from October 1, 1915. A provision was also included for determining the validity of the District bonds and for the appointment of the District as the agent of the Company to operate the system pending such determination. The foregoing are the more important provisions of the agreement.

Title Insurance and Trust Company vs. C. D. Company et al.

Reference has been made to the decision of January 4, 1913, of the Superior Court of Los Angeles County in the case of the Title Insurance and Trust Company vs. the C. D. Company et al., and to its appeal to the Supreme Court of California. The Supreme Court modified the judgment rendered by the Superior Court in several minor respects but affirmed the judgment in all other respects. In a judgment after remittitur, the Superior Court on December 27, 1915, in conformance with the judgment of the Supreme Court, decreed that all of the properties, both real and personal, of the C. D. Company and its Mexican Company be sold "as an entirety and in one parcel, for the purpose of satisfying the liens herein adjudged," at public auction to the highest bidder, and appointed W. H. Holabird - who was the Receiver for the C. D. Company - as the Commissioner to make the sale.

Further, it was provided that the proceeds of the sale should be applied in the following manner and with the priorities as set out, after allowing for payment of costs and expenses of the sale and compensation to the Commissioner:

1. Payment of any principal and interest remaining unpaid on Receiver's Certificates.

2. Payment to the Title Insurance and Trust Company of the Amount of its judgment against the C. D. Company in the sum of $634,211, with interest at 7 per cent per annum from the date of the original judgment - January 4, 1913 - until paid.

3. Payment to the New Liverpool Salt Company of its judgment against the C. D. Company in the sum of $458,246.23, with interest at 7 per cent per annum from the date of that judgment - January 10, 1908 - until paid.

4. Payment to the Southern Pacific Company of its judgment against the C. D. Company in the sum of $1,501,903.63, with interest at 7 per cent per annum from the date of that judgment - December 30, 1909 - until paid.

5. Any balance remaining from the proceeds of the sale was to go to the C. D. Company.

Further provisions of the decree required the Southern Pacific Company to turn over to the Commissioner immediately all of the stock of the New Mexican Company, and enjoined the Southern Pacific Company and the New Mexican Company and their officers from asserting any claim of ownership to the property at any time owned by the C. D. Company or the two Mexican Companies and from transferring or in anywise disposing of such property. There were other provisions to assure that the purchaser of both the C. D. Company and the Mexican Companies secured title upon completion of the sale.

The decree listed in detail all the real and personal property of the C. D. Company and included as one item the entire capital stock of the Mexican Company and the entire capital stock of the New Mexican Company.

Deed to District

The foreclosure sale was held February 8, 1916, at the Court House in Los Angeles, and the Southern Pacific Company purchased the properties for the sum of $3,875,000. The sale was confirmed by the Court on February 21, 1916, and the Commissioner's deed was issued to the Southern Pacific Company February 23, 1916.

In turn, under date of June 22, 1916, the Southern Pacific Company deeded all the properties which it had purchased at the Receiver's sale, except for the lands which had been owned by the Mexican Company, to Imperial Irrigation District, for the sum stated in the deed of $3,000,000. In this manner, Imperial Irrigation District acquired ownership of the canal system, water rights, and properties of the C. D. Company and of the two Mexican Companies. Also, by this transaction, the first Mexican Company went out of existence and the New Mexican Company - Compania de Terrenos y Aguas de la Baja California, S. A. - became the Mexican subsidiary company of Imperial Irrigation District and will be hereinafter referred to as the "Compania". The ownership of the properties of the mutual water companies was not in anywise affected.

In order to simplify the administration of the affairs of the Compania and to eliminate a possible legal question as to the right of the District under Mexican law to own the Compania, the capital stock of the Compania was and still is placed in the names of the individual members of the Board of Directors of the District, who act in the capacity of trustees.

Inclusions in District to 1916

On October 13, 1915, the District was enlarged by the inclusion within its boundaries of 70,700 acres, making its total area 584,068 acres.

IX. FIRST FIFTEEN YEARS OF DISTRICT'S OPERATIONS

The Situation in 1916

Upon the properties of the C. D. Company and its Mexican Companies being deeded to the Southern Pacific Company on February 23, 1916, the District took over operations as the agent of the Southern Pacific Company, in accordance with its agreement with that Company of December 28, 1915. The District bonds had been validated by the Superior Court on April 6, 1915, so full control of all properties passed to the District by the deed to it from the Southern Pacific Company dated June 22, 1916.

Since organization of the District in 1911, its officials had kept in touch with conditions and were fully aware of the problems which had to be met at the time the District took over. The picture was far from encouraging.

Flood Protection

The River was flowing uncontrolled through Bee River and spreading out over the Volcano Lake region through many channels which were constantly changing. Due to the deposit of silt, the elevation of this region was rising very rapidly, ever increasing the flood pressure against the weak Volcano Lake Levee, which was all that stood between Imperial Valley and disaster. The United States Government had withdrawn its assistance in the flood-protection work, leaving the people of Imperial Valley to their own fate at a time when the situation was more ciritical than at any time since the 1905 break.

Mutual Water Companies

Water service to the mutual water companies had been inadequate for several years due to the condition of the canals and the difficulties experienced with the diversion works at Andrade. This situation was made more serious by the injunction secured by the Yuma County Water Users' Association in the summer of 1916 against the District's placing any obstruction whatever in the River. Many structures were in poor condition and additional ones were needed to provide proper service, and there was a lack of equipment necessary to maintain the canal system.

Also, there were the factors relating to the measurement of water, allowance for losses, service to lands not covered by water stock, and others, which had been creating dissension between the mutual water companies and the Receivers and which would have to be solved if the new District was to be successful.

Need for All-American Canal

Last but not least, there was a growing realization of the need for an All-American Canal, which, by diverting at Laguna Dam, would eliminate the uncertainties of the existing diversion works and also the complications of a canal system and water supply dependent upon a foreign government. Moreover, it would facilitate development of additional lands in Imperial Valley. In this connection, an official of the District had been sent in 1914 to confer with the Secretary of the Interior in regard to the district's acquiring a right to divert its water from Laguna Dam, and in 1913 the District had made

a field survey of an All-American Canal.

Cierro Prieto Canal

One of the first improvements undertaken by the District was the construction of the Cierro Prieto Canal diverting from Volcano Lake through a head gate constructed in the Volcano Lake Levee near its lower end at Black Butte. The canal was built to the northwest and then north, a total distance of some sixteen miles, keeping to the south of New River, to a junction with the West Side Main Canal near Wistaria Check.

There were several reasons for building this canal. By diverting water from Volcano Lake, the demand on the Alamo Canal would be reduced. Also, because much of the silt in the River was being deposited in the Volcano Lake region, the silt content of the water diverted would be materially reduced, which would result in a saving to both the District and the landowners in the cost of water service. Moreover, the entire west side of the Valley was dependent upon the flume which carried the West Side Main over New River, and any accident to the flume, such as had occurred in the past, might cause not only great inconvenience to the water users, but severe damage to their crops. The Cierro Prieto Canal would furnish another source of supply, independent of the flume, for the west side of the Valley.

The canal was completed in August 1916 at an initial cost, including the head gate, of about $300,000. Tule Check, on the Cierro Prieto Canal was constructed in the spring of 1917, and the canal enlarged to a capacity of 1,200 second-feet, at a cost of about $125,000.

The water surface of Volcano Lake varied with the amount of flow in the River, and during the periods of lowest flow it was not possible to divert to the Cierro Prieto Canal. For this reason, diversion was made from the Lake to the canal for about twenty days in August, 1916 and intermittently thereafter until September, 1921. The diversion of the River through the Pescadero Cut and out of the Volcano Lake region, made by the District in 1922, dried up the Lake, making further diversion into the canal impossible. After 1917, the canal was served primarily by the Solfatara Canal, discussed at a later point.

Board of Consulting Engineers

In view of conditions on the River and the very serious problem of maintaining an adequate water supply, the District Board of Directors, by resolution of September 26, 1916, appointed a Board of Consulting Engineers to make an investigation and recommend what should be done to cope with the critical situation. The Board consisted of G. G. Anderson and C. E. Grunsky, both of whom were well known for their ability and long experience in connection with Colorado River irrigation matters.

Report No. 1

The Consulting Board issued its Report No. 1 under date of October 25, 1916. This was of a preliminary nature and contained eight recommendations to be carried out immediately. These included a new head gate and intake canal at Andrade, with the use of large suction dredgers for handling heavy silt in the intake canal; improvements to the Alamo canal; and an upstream extension of the Cierro Prieto Canal to a connection with the Alamo Canal.

Report No. 2

By resolution dated November 25, 1916, the District Board authorized the preparation of plans and cost estimates for the recommended work, in order to determine the "amount of money necessary to be raised for the purpose of constructing and acquiring, during the next two years, irrigation canals and works and property necessary to insure the District a permanent and adequate water supply". Pursuant to this resolution, the Consulting Board made its Report No. 2, under date of January 4, 1917, in which were listed forty-three items of work at a total cost of $2,464,000. These included the eight items recommended in Report No. 1 and additional improvements and betterments to carry out a two-year program in accordance with the Board's resolution.

Additional Board Reports

Subsequently the Consulting Board made three more reports. Report No. 3 was dated April 30, 1917, and dealt with conditions on the River and the levee system in respect to items of work included in its Report No. 2. Report No. 4 was dated November 10, 1917, and was made pursuant to a resolution of the District Board dated October 23, 1917, authorizing further investigation of the critical River situation. Report No. 5, also dated November 10, 1917, dealt with the work which had been accomplished on the items for protective works included in the Board's Reports Nos. 1 and 2 and discussed progress to date on other items recommended in those reports.

Second Bond Issue - 1917

Based on the Consulting Board's Report No. 2, a bond issue in the amount of $2,500,000 was voted in 1917. The bonds were dated July 1, 1917, and carried an interest rate of 5 per cent. The issue sold at a discount of $425,000.

Of the funds provided by this second bond issue, about $1,000,000 was expended for improvements at Andrade and in Imperial Valley and the remainder for improvements to the canal and protective levee system in Mexico. All of the work accomplished was included within the items recommended by the Consulting Board. However, a number of the items so recommended were not undertaken at all or were partially completed under the second bond issue, and some were postponed until the third bond issue.

Among the major items of work accomplished with funds from the second bond issue were the following:

1. Rockwood Heading and Intake Canal

Over the years, difficulties with the controlling of diversions through the open intake canal had been increasing, and it was desirable, if possible, to reduce the amount of bedload silt brought into the canal system from the River. Also, it appeared, in the face of the injunction which had been obtained recently by the Yuma Water Users' Association, that permission for the installation of a weir in the River, when required to improve diversion conditions, might be difficult to secure. For these reasons, a new heading, known as Rockwood Heading, was constructed during 1917-18 in the bank of the River 1-1/4 miles upstream from Hanlon Heading, in accordance with the recommendation of the Consulting Board, and the Alamo canal was extended upstream from Hanlon Heading to the new heading.

The new structure was over 700 feet in length and was constructed in the bank and parallel to the flow of the River. It contained 75 openings, each about 6-1/2 feet wide, through which water was admitted to the canal, the flow being controlled by flashboards placed in grooves in the gates. The sills of the upstream 27 gates were 8 feet lower than the remainder, to assist diversion during extremely low flows in the River. In effect, the structure was a long overpour weir, it being contemplated that by drawing from the surface flow of the River, the amount of silt entering the canal would be reduced, the greatest reduction being in the amount of bedload diverted into the canal.

On the River side and at some distance from the heading, a long floating boom was installed to ward off the tremendous amount of debris carried by the River, especially during the flood season. This debris had caused considerable trouble in the open intake canal above Hanlon Heading by becoming imbedded in the silt, which made it very difficult to remove both the silt and the debris.

Two large suction dredgers - one a 20-inch and the other an 18-inch - were purchased for use in the new section of canal between Hanlon and Rockwood Headings for removing the heavy silt which settled there.

The cost of Rockwood Heading was $269,000, including the floating boom. At a later date, steel flashboard gates were purchased for the deep section at a cost of about $6,000, which made the total cost of the structure $275,000. The cost of the new intake canal amounted to $132,000 and that of the two suction dredgers, $309,000 (these dredgers were electrified under the third bond issue). Other work in connection with the new intake, such as the revetment of the River levee from the heading to the international boundary line and of the banks of the new intake channel, totalled $98,000.

As a result of this work, diversion conditions were very greatly improved and much was accomplished to assure adequate service for the project. However, contrary to expectations, Rockwood Heading did not eliminate the necessity for diversion weirs during low-flow periods of the River. Neither did the new gate have the "skimming" effect which had been hoped for. Tests showed that the water in the canal downstream from the gate had practically the same percentage of heavy silt as did the water in the River. Apparently the heavy bed silt of the River hurdled the flashboards in the gate openings. But by use of the suction dredgers, large quantities were removed from the bed of the intake canal, making it possible to divert from a lower elevation of the River than could otherwise have been done.

2. Quarry Equipment at Andrade

About $96,000 was spent in acquiring a locomotive, steam shovel, dump cars, and other equipment for use in the quarry at Andrade and for hauling rock used in protecting the levee system in Mexico. Only about one-half of the equipment recommended by the Consulting Board was purchased under the second bond issue, the remainder being secured with funds from the third bond issue.

3. Solfatara Canal

As recommended by the Consulting Board, the Cierro Prieto Canal was extend-

ed from a point about two miles below its Volcano Lake heading, to the north a distance of sixteen miles to the Alamo Canal at Cudahy Check, the extension being known as the Solfatara Canal. As has been pointed out, diversions to the Cierro Prieto Canal from Volcano Lake could be made only during the higher stages of the flow of the River. So the first purpose of the new canal was to assure a constant supply to the Cierro Prieto, and thus to the west side of Imperial Valley. The upper end of the new canal was located adjacent to and on the westerly side of the Volcano Lake Levee. Excavation from this section was used to raise and strengthen the Volcano Lake Levee. The lower portion of the canal veered away from the Volcano Lake Levee and crossed extensive alkali flats. The area between the canal and the levee was silted in, which not only provided good material for raising the levee, but also gave it backing and increased its stability.

Cudahy Check had been constructed in 1914 with funds provided by the Imperial Development Company, which owned a large tract of land in the vicinity, the check being used for diversion of water for the development of that tract. When the Solfatara Canal was constructed, its heading was located on the Alamo Canal immediately upstream from Cudahy Check, and the District reimbursed the Imperial Development Company in the sum of $43,000 on the cost of the check.

The canal was completed in 1917 at a cost of $171,000.

4. Improvements to the Alamo Canal

Considerable work was done on the Alamo Canal, including the cutting off of bends to improve alignment, widening of certain sections to increase capacity, and channelizing of a number of sections to prevent excessive deposition of heavy silt. On this work, a total of $625,000 was expended.

5. Improvements to Levee System

In accordance with the Consulting Board's recommendation, $500,000 was expended on the protective levee system, principally in extending, raising and revetting the Saiz and Volcano Lake Levees. Conditions which required this work will be discussed at a later point, under the heading of "Pescadero Cut".

6. Other Items of Construction

Among other major items constructed in accordance with the recommendations of the Consulting Board was the replacement of the Alamo Waste Gate at Sharp's Heading. This was a large wooden structure and was the main control not only for the several canals diverting from the Alamo Canal at Sharp's Heading, but also for the regulation of the entire Alamo Canal. It diverted surplus water to the Alamo River and was used in sluicing the lower end of the Alamo Canal. It was originally constructed in 1903, and although the Consulting Board had recommended that it be replaced with a concrete structure, this was not done, the replacement being a similar type of wooden structure costing $86,500.

Also, a concrete wasteway structure was installed on the east side of the West Side Main Canal at Wistaria Heading in Mexico, discharging into a channel leading into New River. The cost of the structure was $45,000.

In addition, there were a number of miscellaneous structures built, such as canal headings, small sluiceways and wasteways, both in Mexico and in the Imperial Valley, which completed the expenditure of funds from the second bond issue.

Third Bond Issue - 1919

As has been noted, the second bond issue was to cover a program of work over a period of only two years. As it proved insufficient even for that program, and also because additional work became necessary, a third bond issue was planned.

Pursuant to a resolution of the District Board of Directors adopted January 7, 1919, the District's engineers submitted two reports, one dated January 16 and the other April 26, 1919, giving estimates of cost for some thirty-four items of additions and improvements to the canal and levee system, at a total cost of $2,500,000. A number of these items covered work which had been recommended in the reports of the Consulting Board but had not been carried out.

To provide the necessary funds, a third bond issue, in the amount of $2,500,000, was voted. The bonds were dated October 1, 1919, and carried an interest rate of 5½ percent and sold at a discount of $189,000. With the funds thus provided, improvements were made to works and facilities at Andrade and in Imperial Valley costing $522,000, and to the canal and river levee system in Mexico costing $1,978,000.

Among the major items of work accomplished were the following:

1. Improvements at Andrade

Among the items of expenditures on improvements at Andrade was the purchase and installation of a heavy-duty cableway spanning the River at the location of the diversion weir for use in building the temporary weirs, the cost being $74,000. Additional equipment was purchased, including another locomotive, a number of dump cars, a steam shovel, and minor equipment for use in the quarry and for transporting rock used on the levees, at a total cost of $181,000. Electrification of the two large suction dredgers used in the intake channel between Rockwood and Hanlon Headings cost $95,000. Additional trackage for the quarry and other miscellaneous improvements at Andrade cost $64,000. The total of all expenditures at Andrade was $414,000.

2. Canal System in Imperial Valley

The main items of expenditure on improvements in Imperial Valley consisted of repair and additions to the wood step-drops below the Rositas Wasteway on the Alamo River, at a cost of $62,000, and the making of a drainage survey of the Valley, at a cost of $40,500. (The subject of drainage is discussed at a later point, under that heading.) These items, together with miscellaneous improvements, made total expenditures for the Imperial Valley, $108,500.

3. Canal System in Mexico

Items of expenditure in connection with the canal system in Mexico included replacing Sharp's Heading - i.e., the Central Main and Ash head gates - with a reinforced-concrete structure costing $147,000; reconstructing and enlarging Cudahy Check, $95,000; replacing East Side Heading, $69,000 Wistaria Check, $30,000, and Wardlaw Check (concrete), $24,000; purchase of dredging equipment, $41,000; installation of miscellaneous structures and alignment of the Alamo Canal, $109,000. This made total expenditures on the canal system and for equipment in Mexico amount

to $515,000.

4. River Levees - Mexico

Expenditures in connection with the protective levee system in Mexico included the further extension, raising, and revetting of the Saiz and Volcano Lake Levees and rebuilding and revetting of the Ockerson Levee, at a cost of $886,000.

Because of the distance required to haul rock from the Andrade Quarry to the Volcano Lake Levee and the complication involved in passing District equipment over the Inter-California Railroad en route, a new quarry was developed in the Cocopah Mountains a few miles southerly from the lower end of the Volcano Lake Levee, being known as Cocopah Quarry. The cost of its development, including a railroad from the quarry to the Volcano Lake Levee, was $234,000. This made the total of all expenditures under the third bond issue on river levees in Mexico amount to $1,120,000.

The work under the third bond issue extended over the latter part of 1919 and through the years 1920 and 1921.

Diversion Weirs

Temporary Injunction

As has been mentioned, the 1915 temporary diversion weir was built with brush, as River conditions were comparatively favorable. However, the situation worsened in 1916, following the spring flood of 200,000 second-feet out of the Gila River, and it was deemed necessary to rebuild the old rock weir, in order to raise the water surface in the River sufficiently to meet the anticipated diversion requirements.

After the District commenced rebuilding the rock weir, the Yuma County Water User's Association brought an action in the Superior Court of Yuma County, Arizona, seeking to enjoin the District from placing any obstruction in the River. The basis of the suit was that the raising of the water surface of the River would endanger the levee system of the Yuma Project and threaten flooding of the farm lands. Also, it was claimed that the raised water level in the River would increase seepage under the lands of the Yuma Valley "Impregnating the said land with an excessive quantity of deleterious salts".

Under date of August 1, 1916, a temporary restraining order was issued by the Court, enjoining the District from placing any obstruction in the Colorado River for the purpose of raising the River to divert water to the canals of the District and giving the District until August 10, 1916, to show cause why a permanent injunction should not be issued.

Modification of Injunction and 1916 Weir

By stipulation of the parties, the temporary restraining order was modified under date of August 3, 1916, whereby the District, upon giving a surety bond in the sum of $100,000 for faithful performance, was permitted to construct the temporary weir on the condition that rock no larger than 1/2 cubic yard in size would be used, and further that the trestle would be removed not later than November 1, 1916, and any other obstruction to the flow of the River by January 1,

1917. Accordingly, the temporary weir was built on the remaining portion of the rock weir which had been constructed in 1910. The maximum head on the weir for 1916 was 4-1/2 feet.

The temporary restraining order was continued in subsequent years by agreement between the Water Users' Association and the District, and the hearing on the permanent injunction was never held.

1917 Weir

The diversion situation was even worse in 1917 than in 1916, for several reasons. Following the long sustained summer flood of 1917, the Intake Canal was in a badly choked condition, the River channel did not silt in as it had in other years, and the water surface in the River at the mouth of the Intake Canal was from 2-1/2 to 3 feet lower with the same flow in the River than it had been before.

Under agreement with the Yuma Water Users' Association, and a permit from the War Department discussed below, the temporary rock weir was constructed again in 1917, with the same limitation upon the size of rock used as in 1916. This was the largest weir the District at any time constructed. Because the District lacked equipment for the work, a steam shovel and dump-car equipment were secured from the Reclamation Service. The required head on the weir amounted to 8-1/2 feet, the maximum for any weir constructed by the District.

The contract between the District and the Yuma County Water Users' Association in 1917 giving the District permission to install the temporary weir provided that the District had to deposit $5,000 with the Project Manager of the Yuma Project to cover cost of work in protecting the Arizona bank of the Colorado River and the Yuma Levee, and also had to advance such additional sums as might be required for that purpose. The District also had to furnish a $25,000 faithful performance bond and a surety bond in the amount of $100,000 to cover any damages to Yuma Valley.

By the time of the low-flow in the River in 1918, the new Rockwood Heading had been completed, which, together with dredging between Rockwood and Hanlon Headings, improved diversion conditions to a marked degree, and the temporary weirs constructed in that and subsequent years were required to raise the water surface in the River a maximum of only a few feet.

Use of Brush Mats

In 1918, rock was used in building the temporary weir for the last time. In its place, the district developed the use of brush mats. The mats were constructed in the shape of a wedge, the brush being held in place by long poles which were lashed together. For placing the mats, a permanent cableway was constructed across the River over the location of the rock weir. The mats were placed with the wedge end pointing upstream and were held in place by cables attached to dolphins a short distance upstream from the weir. Within a matter of a day or two after being placed in the River, the mats would silt up and form a barrier. Not only was this method of building the temporary weir less costly than by the use of rock, but the mats could be removed much more quickly and at less cost than could rock, prior to a flood in the River.

1918-1922

In 1918, the annual contract with the Yuma Water Users' was similar to that of 1917 except that the surety bond was increased to $500,000. Similar contracts were made in subsequent years, with changes which will be discussed.

In 1919, the use of rock was forbidden, and the Yuma Water Users' Association was authorized to employ an inspector at the weir at the rate of $12.00 per day, to be paid to the Association by the District.

In 1920, the contract was made to cover two years. It required the District to take immediate steps to secure both a new point of diversion and the funds required for constructing such new works as would be necessary, to the end of eliminating the necessity for the weir. For each day of default in starting the work within three months after funds had been secured, the District would be charged a penalty of $500. The per diem rate of pay for the inspector was increased from $12.00 to $24.00.

In connection with the installation of the cableway across the River, the District had to rent a small parcel of private land on the Arizona side as the location for the tower at that end of the cableway. This parcel was river-bottom land of little value, but nevertheless the District was forced to pay the owner a rental of $1,200 a year. The 1922 contract between the District and the Yuma Water Users' contained a provision guaranteeing payment of this rental by the District to the owner of the parcel. Another new provision in the 1922 contract gave the Project Manager of the Yuma Project the right to remove the weir if, in his opinion, its maintenance was a menace to the City of Yuma or lands of the Yuma Valley and if the District did not immediately carry out such removal upon his request.

1923-34

In the summer of 1924, although the brush weir was installed, the flow in the River dropped so low that a sand dam was constructed in the River immediately below Rockwood Heading with material obtained from the discharge of the suction dredgers in the intake channel. This sand dam was completed on August 4, and used from that date until October 16, to divert the entire flow of the River into the Alamo Canal, except for a few hours on August 31, when the sand dam broke.

Between 1923 and 1932, permission to construct the weir was obtained by the District each year, either by a renewal of the contract with the Yuma Water Users' by agreement of the parties or by a new contract having the same terms as the previous one.

The contract for the year 1932 reduced the surety bond from $500,000 to $100,000.

The contract for 1934, because the start of storage by Hoover Dam was imminent, provided that the $100,000 surety bond would not have to be furnished by the District unless the weir was constructed, in which event the bond was to be furnished not less than five days before work commenced, and also that there was to be no payment for an inspector until such work was actually in progress. It was further provided that the rental of the parcel of land for the Arizona

tower of the cableway was not to be paid beyond April 1, 1935.

The last contract was made in 1935, which extended its terms for one year.

Permits from War Department

Commencing in 1916 and for each year thereafter, an annual permit was secured from the War Department for the construction of the temporary weir.

The permit for 1916 required that the weir had to be entirely removed before the floods of 1917.

The permit for 1917, for the first time, required the District to furnish a faithful performance bond to the United States in the sum of $25,000.

The permit for 1919 required the District to make arrangements satisfactory to the Secretary of War by which the necessity for the temporary weir would be dispensed with, the District to report in detail on the first and fifteenth of each month what measures were proposed for this purpose and progress being made.

The permit for 1920 eliminated the necessity of the $25,000 performance bond. There were a few other minor changes in subsequent years, but in general the terms of the annual permits were the same, the last permit being issued in 1932.

Erosion on Arizona Shore and Yuma Levee

Because of the rock foundation which was developed over a period of years, the location of the weir remained the same even after the new Rockwood Heading was put into operation. As has been mentioned, the weir was placed at an angle of about 70 degrees, which had the effect of deflecting the River below the weir toward the Arizona shore and the Yuma Project levee, causing serious erosion. There was also some erosion on the Arizona side above the weir. The District was required to repair and protect the affected sections. The work extended over the period 1916 through 1921 and included the major items of raising and rock revetting of the Yuma levee for about a mile downstream from the weir and, in 1920, the driving of a trestle some 3,500 feet in length along the Arizona shore below the weir. This trestle served to break up eddy currents and catch debris coming down the River, thus building up a silt bar as protection to the levee. The total cost of the work amounted to $155,000.

Conditions Subsequent to 1927

Although arrangements were made each year to install the weir if required, the last weir was constructed in 1927. In subsequent years, the bed of the River was somewhat higher than in previous years, and diversion in low-flow periods was also assisted by the discharge of sand into the River from the suction dredgers in the intake channel below Rockwood Heading. In this connection, it should be noted that in the early thirties the River level at Rockwood Heading was some 2½ feet higher for comparative flows than it was in the year 1922.

These conditions made it possible to meet diversion demands after 1927, except in years of exceptionally low-flow periods, and then a sand dam was used. Such a sand dam, similar to that described for 1924, was constructed in 1931,

and the entire flow of the River diverted from July 23 until August 7, when the dam was cut, being reclosed on August 20. It broke on August 21, was closed again on the 22nd, and the entire River flow diverted until October 1. In 1932, a sand dam was required from September 23, until October 2.

In the year 1934, the discharge of the Colorado River was the lowest of record and resulted in an acute water shortage in Imperial Valley. This was the year prior to the commencement of storage in Lake Mead behind Hoover Dam. A sand dam was completed June 22 and remained intact until December 25, the entire River flow during this period being diverted to the Alamo Canal.

With the regulation of flow of the River provided by storage in Lake Mead behind Hoover Dam, which was commenced in February 1935, and later by use of the All-American Canal, diversion problems of the District were eliminated.

Pescadero Diversion

The Situation Confronted

By 1920, conditions in the Volcano Lake area and their effect on Volcano Lake and Saiz Levees had become so critical that it was realized relief in some manner would have to be provided. As has been mentioned, the Volcano Lake Levee was started in 1908, when the River diverted itself from its old course along the Sonora Mesa, to Bee River and Volcano Lake. Subsequently, the levee had been extended and raised, and by 1915 it was at a height of from 9 to 11 feet; by 1920 it had been raised to a height of between 15 and 16 feet. There had been several minor breaks in the levee, but fortunately none had proved serious, and it had been nearly overtopped on several occasions.

It is interesting to note that in the early 1900's the elevation of the bed of Volcano Lake was about 18 feet above sea level, in 1911 it was 28 feet, and by 1920-21 it was 40 feet. This rapid rise of the bed of the lake was due to there being no definite river channel through the area, which was thickly covered with vegetation; consequently, the flow of the river was caused to spread out, depositing most of its silt in that area.

Diverting the River

Consequently it was decided to divert the River from a point on Bee River a few miles westerly from the 1908-09 break, southerly into what was called the Pescadero Basin, which lay between the high area along the old river channel on the easterly side of the delta and the newly raised area of the Volcano Lake region. The diversion was accomplished in 1921-22.

Three parallel channels were excavated from Bee River, at the point selected for diversion, southerly for a short distance, to serve as pilot channels for the diverted flow, and the Ockerson Levee was extended down to the point of diversion - the extension being named Bee River Levee.

Closure of Bee River by a rock-filled dam at the point of diversion was made in the spring of 1922, using the same method as was employed in the closure of the 1905 break, that of building a trestle across the River and dumping rock and gravel. Thus the River was diverted through the pilot channels, which eroded to form one large channel, and by the end of 1922 flood season, the entire flow was passing into Pescadero Basin. This dried up Bee

River below the dam, and consequently the Volcano Lake region, which gave temporary relief to Imperial Valley from the existing serious menace. The cost of this work to the end of June 1922 was about $375,000.

Pescadero Levee

In 1923, a levee was constructed and rock revetted from the south end of the Bee River Dam southerly along the new diversion channel for nearly six miles and was equipped, as were most of the other levees, with a standard-gage railroad. This levee became known as the Pescadero Levee. It was extended several miles further in 1926, but a break occurred near the lower end of the extension in the flood season of that year and it was not repaired. The total cost of the Pescadero Diversion through 1923, including Bee River Levee, Bee River Dam and diversion channels, and Pescadero Levee was $530,000.

Lands in Mexico Benefit

Pescadero diversion also benefited large areas of land in Mexico, both in the Volcano Lake area and in the area east of the diversion.

In 1928, over the protest of the District, the Colorado River Land Company, with the approval of the Mexican Government, installed five siphons over the Bee River Dam for diverting water into the old Bee River Channel downstream with which to develop lands in the Volcano Lake area. That Company also built a canal (Delta Canal) from Cudahy Check on the Alamo Canal southwest to the same area.

Also, in 1929, Mexican interests attempted to develop the lands to the east of the Pescadero diversion. To do this they constructed a levee from high ground at San Luis, Mexico, westerly along the south side of the River to the Pescadero diversion and southerly along the latter for several miles. To irrigate the area thus protected, a siphon installation was made in the new levee just east of the Pescadero diversion and a main canal - Vacanora Canal - constructed to the south from the siphons for some eighteen miles.

The floods of 1929 broke the new levee and by the end of the year the entire flow of the River was passing down the Vacanora Canal, which became, as it is today, the main channel of the River. However, in subsequent years a large area of these lands was developed by pumping directly from the River and by use of surplus water from the lower end of the Yuma Project.

This shifting of the River's course to the Vacanora Canal also caused the silting in of the Pescadero diversion channel and the River channel upstream from Bee River Dam, which blocked off the siphons over Bee River Dam and prevented their further use. Thereafter the developed lands in the Volcano Lake area were supplied by the Delta Canal from Cudahy Check.

Summary of Flood-Protection Work

By 1930, the protective levee system of the District in Mexico totalled 74.5 miles in length, 45.5 miles of which was provided with a standard-gage railroad. The District also had a well-developed quarry at Andrade, with all the equipment necessary for its operation; the Cocopah Quarry had been abondoned with the building of the Pescadero Diversion. Between 1916 and 1933, the District used some 800,000 cubic yards of rock in connection with the protection of the levee system. Total expenditures by the District for river-protection work amounted to $4,900,000.

By reason of the low flood flows in the Colorado River subsequent to 1930 and the control afforded by Hoover Dam in 1935, only a small amount of work was required on the District levee system subsequent to 1930. Responsibility for the levee system was later assumed by the Governments of the United States and Mexico under the terms of the 1944 treaty.

So long as the River runs on a ridge, as it now does and as it will continue to do, several hundred feet above the Imperial and Coachella Valleys, and the flood plane continues to rise, as it is bound to, the District's levee system will be required and should be maintained in order to assure the measure of permanent safety to these Valleys which the ever-increasing investments made therein and their importance to the Nation warrant.

Fourth Bond Issue - 1922

For the purpose of providing funds for the purchase of the mutual water companies and for construction of a deep drainage system, the fourth bond issue of the District was approved by the voters on June 1, 1922, in the amount of $7,500,000. Of this total, $5,000,000 was to be used for the purchase of the mutual water companies and $2,500,000 for drainage construction. The bonds were dated July 1, 1922, and carried an interest rate of 6 percent per annum. This was the last issue of general obligation bonds of the District. In subsequent years, only power revenue bonds were issued, in connection with the development of the District's power system.

The bonds of the fourth issue were sold in blocks of varying size over the period 1922-1925, the earlier blocks selling at 94 percent of par, increasing in subsequent blocks to 97.5 percent, and in 1924 to par. The final block of $450,000 was sold in 1925 at 101.0 percent. The total discount on the sale of the bonds amounted to $316,750. Of the remaining $7,183,250 realized from the proceeds of the sale, $4,724.697 was expended in the purchase of the mutual water companies and $2,458,553 on drainage.

Absorption of the Mutual Water Companies

Reasons for Absorption

With the formation of an over-all irrigation district in 1911 and the improved conditions which followed the taking over of the properties of the C. D. Company and its Mexican subsidiaries by the District in 1916, the proposition of eliminating the mutual water companies and having the District assume control of all operations in Imperial Valley began to take definite shape. It became apparent that there was no real justification for having thirteen mutual water companies, each with its own board of directors and other officers and with its own equipment, shops, etc..., which resulted in much greater overhead costs than were necessary. Furthermore, the smaller companies were handicapped in their operations because of size. Also, with the need for a system of deep drains becoming apparent, which system would have to be built without regard to the boundaries of the mutual water companies, further complications came into view.

Another factor involved was the allowance which had been made by the C. D. Company, and later by the District, to the mutual water companies for losses in their canal systems and necessary waste, in connection with the delivery of water. This allowance depended upon conditions for each mutual company and had been changed from time to time. It was the cause of considerable dissension among the different companies.

The matter of delivery of water to lands not covered with water stock was also a factor. Even before the District took over the private company's operations, the Receiver had been making some deliveries to such lands. When the District took over, the law required it to deliver to any land within the District boundaries desiring water service.

To add to all of the foregoing, some of the water companies had let their distribution canal systems get into poor condition and many of the companies had become delinquent in their water rental payments to the District; as of November 1, 1920, this delinquency amounted to almost $272,000, increasing by November 1, 1922, to $547,000.

Contracts for Purchase

For the foregoing reasons, negotiations were carried on over a period of a year or more between the District and water company officials, resulting in contracts being entered into between the District and each individual water company providing for the District to acquire the company upon a payment of $10,00 an acre for each acre of land fully water-stocked, plus the appraised value of the equipment and miscellaneous properties of the water company. The funds for this acquisition by the District were included in the fourth bond issue.

Details of Absorption

The absorption of the mutual water companies commenced November 1, 1922, and was completed March 1, 1923. A board of appraisers fixed the value of the equipment and miscellaneous properties of the water companies. As the bonds did not sell for par, it was necessary to reduce the payment to $9.45 for each acre of water-stocked land, with a further reduction of 3½ percent on all payments, made necessary when the appraisers board had completed their work. The final settlement also included adjustments on delinquent water rentals and on other accounts amounting to $202,674.

The following tabulation shows the final workout of the absorption of the individual mutual water companies, which was concluded for the total figure of $4,724,612:

ABSORPTION OF MUTUAL WATER COMPANIES
BY IMPERIAL IRRIGATION DISTRICT

Water Company	Year Organized	Date Operated by District	Quitclaim Deed to IID Dated	Number of Acres Represented	Shares of Water Stk. Issued	Paid by District		
						For Water-Stocked Land	For Equipment and Works	Total
No. 1	1900	Nov.1,'22	Nov. 1,'22	121,169.27	100,000	$1,104,972.86	$182,391.74	$1,287,364.60
No. 2	1913	Nov.1,'22	Nov. 3,'22	7,218.00	7,218	65,822.75	10,775.60	76,598.35
No. 3	1913	Mar.1,'23	June 9,'23	53,108.32	47,448	484,308.04	35,568.54	519,876.58
No. 4	1900	Nov.1,'22	Oct.28,'22	20,811.70	20,043.5	189,786.78	13,323.27	203,110.05
No. 5	1901	Nov.1,'22	Nov. 1,'22	96,006.00	90,013	875,502.71	80,228.57	955,731.28
No. 6	1901	Nov.1,'22	Oct.30,'22	21,031.00	19,764	191,786.95	6,783.58	198,570.53
No. 7	1902	Nov.1,'22	Oct.10,'22	19,302.00	18,245	176,019.77	16,981.55	193,001.32
No. 8	1902	Nov.1,'22	Dec. 1,'22	47,012.33	44,524	428,717.22	60,263.30	488,980.52
No. 9	1919	Feb.1,'23	Dec.27,'22	21,283.50	19,968.5	194,089.55	147,722.37	341,811.92
No. 12	1908	Nov.1,'22	Oct.31,'22	16,102.00	16,235	146,838.15	15,923.19	162,761.34
Eastside	1912	Nov.1,'22	Oct.30,'22	4,183.00	4,170	38,145.82	2,253.27	40,399.09
Southside	1912	Nov.1,'22	Oct.24,'22	18,352.00	18,352	167,356.47	29,096.54	196,453.01
S. Alamo	1912	Nov.1,'22	Nov.11,'22	1,904.00	1,904	17,363.33	2,684.78	20,048.11
New River	1917	-	May 31,'23	1,410.00	1,410	12,816.90	27,183.10	40,000.00
TOTAL				448,893.12	409,295	$4,093,527.30	$631,179.40	$4,724,706.70
Miscellaneous Credit Adjustment								94.70
Total Cost								$4,724,612.00

* Formerly North End Water Company Organized June 3, 1908.

LIST OF WATER COMPANIES
and
ARTICLES OF CORPORATION
of which are on file
COUNTY CLERK, IMPERIAL COUNTY.

213	Imperial East Side Water Company	March	21, 1912
223	Imperial East Side Water Company	April	17, 1912
192	Imperial South Side Water Company	November	15, 1911
239	Imperial Water Company No. 1	November	11, 1908
239	Imperial Water Company No. 1	May	17, 1909
254	Imperial Water Company No. 2	February	10, 1913
239	Imperial Water Company No. 1	August	6, 1912
286	Imperial Water Company No. 3	May	21, 1913
343	Imperial Water Company No. 3	May	4, 1914
73	Imperial Water Company No. 5	May	27, 1909
37A	Imperial Water Company No. 6	March	3, 1908
37	Imperial Water Company No. 6	August	7, 1908
121	Imperial Water Company No. 7	May	13, 1910
29	Imperial Water Company No. 8	May	27, 1908
314	Imperial Water Company No. 9	December	24, 1913
587	Imperial Water Company No. 9	February	19, 1919
593	Imperial Water Company No. 9	April	10, 1919
20	Imperial Water Company No. 10	April	27, 1908
28	Imperial Water Company No. 12	May	25, 1908
63	Imperial Water Company No. 12	March	12, 1909
624	Imperial Water Company No. 14	October	31, 1919
292	Imperial West Side Water Company	June	9, 1913
229	Imperial South Alamo Water Company	May	17, 1912
30	North End Water Company	June	1, 1908

Results of Absorption

The absorption of the mutual water companies was the last step in having the District take over the entire project. The District was now solely responsible for the operations of the Compania; the protective levee system; the diversion, transportation, distribution, and delivery of water from the Colorado River to the head gates of the individual water users, covering a service area at the time of some 540,000 acres of land, including the cities and towns; and the construction, operation and maintenance of a drainage system for the entire Valley.

This was a most worthwhile step and not only resulted in very great economies in operations, but gave to Imperial Valley a strong central organization to deal with its problems.

Drainage System

Need Realized

Even before the District acquired the properties of the C. D. Company in 1916, there had been a growing realization that drainage of the lands in Imperial Valley was becoming necessary. A high water table had developed in several areas, particularly on the east side of the Valley following the construction of the East Highline Canal, which was affecting crop production in those areas; in fact, a considerable area of land had gone out of production.

Several of the mutual water companies, particularly on the east side of the Valley where the slope of the land was steep, had constructed a few hundred miles of what were called "surface waste ditches". These were very shallow and had as their main purpose the draining of surplus surface irrigation water from the lower end of the fields, but in no sense did they serve to drain ground water.

The fact that Imperial Valley, prior to the twenties, had not fully appreciated the necessity for drainage and had failed to construct a drainage system, was not unusual; western reclamation projects had paid little attention to drainage needs up to that time.

Investigations and Plans

But as the 1920's approached, the situation in the Valley became much more serious, and this was the reason for including an amount for drainage investigations in the third issue of bonds in 1919.

Investigations were started, to a minor extent, in 1920 and expanded in 1921, when in November of that year the services of a consulting drainage engineer were secured by the District. A grid system of lines north and south, and east and west, spaced at one-mile intervals, over the entire Valley was laid out, on which were located observation wells for noting the elevation of the underground water table and the type of soil. Readings of these wells were made at least once a month and have been continued to date. Areas of high ground water were found in various portions of the Valley, and from the information thus secured, a comprehensive system of main drain outlets was laid out for the areas of greatest need, utilizing, with but one or two exceptions, the Alamo or New Rivers as outlets to Salton Sea.

Construction of Deep Drains

The major portion of the work was carried on with the $2,500,000 made available from the fourth bond issue, and by 1929, when these funds were exhausted, there had been completed a total of 190 miles of deep drain outlets. In addition, General Fund monies had been used in the construction of 44 miles of such drains, making the total 234 miles at the end of 1929.

Soils of Imperial Valley

These main drains were but a start toward solving the drainage problem of Imperial Valley. While such a system of deep drains had to be provided in any event, yet it was found that in most instances their effect did not extend to a very great distance laterally, for reasons which will be explained.

The soils of the delta portion of Imperial Valley - the area then developed are made up of alluvial deposits of fine textured clays, silts, and sands laid down by the Colorado River, the thickness and type of a stratum at any particular location having been determined by the course of the River and the type of silt it was carrying when the deposit occurred. The result is a very greatly stratified soil, made up of lenses or pockets of varying size and type of material, and this condition tends to retard natural drainage. There are no gravel and sand water-bearing strata and hence no "general" underground water table such as is found under many western irrigation projects. In most parts of the Valley, the water table is perched on underlying relatively impervious strata, so that drainage by deep-well pumping, successfully used in many projects, is ruled out.

These conditions made the problem of adequate drainage of the lands in the delta portion of Imperial Valley one of the most difficult of solution of any to be found in the West. Drainage methods which have been successful in areas of homogenous soils are not adapted to the stratified, alluvial and lacustrine soils of Imperial Valley.

Expansion of Drainage System

It became apparent that the answer to the problem was a drainage system that would meet the varying soil conditions on the individual farms. To this end, the District began an expansion of its drainage system, as rapidly as funds would permit, to reach each 160 acres of land throughout the Valley. Such would then provide an outlet for whatever additional drainage facilities as might be required on the individual farm to give it adequate drainage.

The program required the development of a lateral drain system by the deepening of existing surface drains to a depth of 6 or 8 feet and the construction of additional deep drains to serve as outlets. Also as a part of the program, the District adopted a policy of cooperating with the individual landowner in the making of a detailed survey and examination of his land, from which facilities to provide adequate drainage could be designed, and, if the landowner proceeded with the installation, furnishing all the engineering work required, all without expense to the landowner, but the latter was required to pay all other costs of the installation. As further assistance in getting the work underway, the District purchased two tile-laying machines, the use of which it furnished to the landowner at cost.

The first installation of farm tile drains was made in 1929, followed by a number of others in that year and in 1930. While it was found that much had to be learned as to the location, spacing and depth of installation of the tile lines, the indications were that by this method the Valley could be adequately drained. The tremendous development in the use of tile drains in later years will be discussed in another chapter.

In addition, the District cooperated with the individual landowner in the construction of open drains on his land, where such were necessary, the District doing the work at cost for the landowner.

By the end of 1930, the drainage system of the District comprised, in addition to the 234 miles of deep drain outlets already mentioned, some 740 miles of lateral drains. The installation of tile drains on individual farms totalled about 10 miles, and there were a number of miles of open farm drains.

Elimination of Low Line (No. 5 Main) Canal

A project relating to the drainage program, which was undertaken by the District soon after the absorption of the mutual water companies, was the elimination of the Low Line Canal. This canal was the main feeder for the western half of No. 5 Heading at the south boundary of that Company's area and on to the north some 15 miles to the north boundary. Seepage from this canal had waterlogged a considerable area of land lying on both sides of it throughout most of its length.

The elimination, which was financed from General Funds, was accomplished by extending irrigation laterals at ½ mile intervals from the East Highline Canal westerly across the Low Line Canal, by flume, to the corresponding laterals which had been served from the latter canal. Also involved was the enlarging of the East Highline Canal to meet the increased demand due to serving the area formerly served by the Low Line Canal.

The work was started in 1923 and completed in 1927. Not only was the previous seepage trouble corrected, but it made possible the conversion of the entire Low Line Canal into a deep drain, proving of great benefit to the area affected.

Alamo and New Rivers

Another problem related to that of drainage was the maintenance of the channels of the New and Alamo Rivers and their outlets to the Salton Sea. Very little work had been done on the channels, prior to the absorption of the mutual water companies by the District, as there was a question as to who was responsible. From 1922 on, however, the District has done considerable work in maintaining the alignment of the channels of both Rivers by cutting off bends, controlling bank erosion, and similar work.

The outlets of the Alamo and New Rivers to Salton Sea started to give trouble in the early twenties. As long as the elevation of the Sea was dropping, as it did following the closure of the break in 1907 until about 1920, little difficulty was experienced with the large amount of silt sluiced from the canals in Imperial Valley and Lower California and transported to the Sea by two Rivers. However, as the elevations of the Sea levelled off, the raising of

the deltas at the mouths of the two Rivers produced, on a small scale, the same conditions that existed on the delta of the Colorado River in Mexico. The increasing height of the deltas backed up the water in the two Rivers, causing them to overflow and flood lands in crop.

This trouble became quite serious in 1923. To settle the damage claims filed by the affected landowners, a board of arbitration was appointed, which, after hearings were held, made awards to the claimants totalling nearly $120,000 which included an allowance of $5.00 per acre for a flooding easement.

From then on, it became necessary to control the outlets. This was accomplished by constructing new outlets for each of the Rivers, from time to time, and by raising the banks of the Rivers upstream to prevent overflow.

Inclusions in District to 1930

At the time the District was organized in 1911, the East Highline Canal had not been constructed and therefore was not used in locating the easterly boundary of the District. In later years, the area between the original boundary and the East Highline Canal was included in the District. Also, some 16,000 acres to the north of Niland was included, as well as several areas on the westerly side of the District and various tracts along other portions of the boundary line. As of 1930, the total area within the boundaries of the District was 612,658 acres, which of course, included all of the cities and towns of the Valley.

Following is a tabulation showing the inclusions to the District between the date of its organization and 1930.

	Acreage Included	Total Area of District
Area of District at Organization in 1911		513,368
Inclusions:		
October 13, 1915	70,700	584,068
February 27, 1918	20,230	604,298
November 20, 1923	800	605,098
January 27, 1925	360	605,458
June 11, 1925	960	606,418
August 19, 1930	6,240	612,658

Inclusions since 1930 will be shown at a later point.

Other Developments and Events

Colorado River Legislation

Over most of this period, the long struggle took place to secure legislation authorizing the construction of Hoover Dam and the All-American Canal; also involved was the negotiation and ratification of the Colorado River Compact. Although it had its beginning soon after the District was organized in 1911, the major struggle took place commencing with the introduction in 1919 of the first Kettner bill providing for the construction of the All-American Canal and culminated in the approval on December 21, 1928, of the Boulder Canyon Project Act. These matters will be discussed in more detail in a subsequent chapter, on the All-American Canal.

Power Investigations

During the early twenties, the electric utility serving Imperial Valley had made several increases in the rates charged for power, which created local demand for the District to see what could be done about the situation. As a result, and also in anticipation of there being power possibilities available on the All-American Canal, the District commenced investigations in 1926 of hydroelectric power development on its existing canal system to supply the Valley. This was the forerunner of the present extensive power system of the District, which will be discussed in a subsequent chapter under the subject of Power.

Collapse of Cotton Prices

One event which had a serious effect on the economy of the Valley was the collapse of cotton prices in 1920. For several years prior, the acreage on which cotton was grown in the Valley had been increasing at a rapid rate to a maximum of over 100,000 acres in 1920. This increase in acreage had been occasioned by a corresponding increase in the price of the product. However, in 1920, when the crop was harvested, the anticipated price of at least a dollar a pound had slumped to less than 10 cents a pound. As a result, there were tremendous financial losses to the growers, and this, together with a general decline in the prices received for agricultural products which occurred in 1921, depressed the economy of the Valley to such an extent that it was several years in recovering. Another result was that the cotton acreage over the next several years was reduced to practically nothing, and it was not to return as a prominent crop until very recent years.

Water Delivery Charges in Mexico

The charge which the District, through the Compania, was permitted by the Mexican Government to make for water delivered to lands in Mexico remained at a rate of approximately 50 cents per acre-foot until 1919. In that year, the Company presented statements to the Mexican Government showing that this rate was far below the cost, and as a result the Government permitted the rate to be increased to approximately 86 cents per acre-foot, where it remained until 1931. This question of a charge to the water users in Mexico which would properly reflect their share of the total cost of flood protection, water operations, and fixed charges, was always a source of contention between those users and landowners in Imperial Valley. As reflected in the books of the

the District, the water users in Mexico at no time paid their just share of total costs, which meant that the difference had to be carried by water users in Imperial Valley.

Water Delivery Charges in Imperial Valley

Prior to 1924, water users in the United States paid $1.00 per acre-foot for all water delivered, plus an assessment on their land of $2.50 per hundred dollars of valuation. In 1923, the assessment rate for 1924 was increased to $5.00 per hundred dollars of assessed valuation. The water charge remained at $1.00 per acre-foot, but an assessment credit was allowed to apply on water paid for, equal to one-half of the assessment.

This assessment was attacked in the Superior Court by a water user in an injunction suit brought in December, 1923 to prevent the collection of any money in excess of 2 percent of the assessed valuation for operating costs, it being claimed this was the maximum allowed by law, and also to prevent the collection of charges for the delivery of water. The Court granted the injunction, but it was completely reversed by the Supreme Court of the State in May of 1924.

The same assessment rate, water charges and credits were continued in 1925. But commencing January 1, 1926, the charge for water delivered to lands was eliminated, except for a service charge of 25 cents per delivery gate for each day that water was delivered. This arrangement continued until 1932, when a water charge was again established, as discussed in the following chapter.

Operating Headquarters Moved to Imperial

With the absorption of the mutual water companies by the District, not only was there a tremendous expansion in the forces and work of the District, but the center of activities also shifted north from the international boundary line. For these reasons, the operating headquarters of the District were moved in September, 1925 from the old headquarters in Calexico, where they had been located since 1901, to Imperial, and offices, shops, warehouse and other facilities were greatly expanded.

Niland Water District

Above Niland was an area of some 16,000 acres lying north of what had been Water Company No. 3. For the construction of a canal and lateral system to serve this area, the landowners organized the Niland Water District under the California County Water District Act. A contract was entered into between that District and Imperial Irrigation District under date of December 6, 1927, providing that the Niland District would extend the East Highline Canal and build a lateral system which, when completed, would be purchased by Imperial, over a period of years, at its actual cost of construction and thereafter operated and maintained by Imperial as a part of its system. The work involved included the extension of the East Highline Canal for about 5½ miles to the north and of Imperial Irrigation District, the construction of laterals totalling about 50 miles in length, and the construction of some 53 miles of lateral drains.

The Niland District proceeded with plans to issue bonds in the amount of $140,000 to finance the work, but was unable to sell the issue. For this reason, a second contract was entered into between the two Districts, dated January 31,

1929, which provided that the Imperial District would construct all of the works, with the Niland District paying for the excavation and Imperial standing the cost of the necessary structures. Work performed by Imperial in 1929 under this contract included the extension of the East Highline Canal for 2½ miles and the construction of five laterals extending westerly to Salton Sea, totalling 32 miles in length, together with parallel surface drains from the Southern Pacific Railroad to the Sea. In subsequent years, Imperial continued construction until the proposed work was completed.

Miscellaneous Canal System Improvements

The Thistle Canal on the west side of the Valley west of Brawley was enlarged and its laterals extended to make possible the development of several thousand acres of new land. Also, the Trifolium (West Side Main) Canal was extended for several miles to the western boundary of the District, with laterals to the north to serve a considerable area lying south of Salton Sea.

In addition to funds provided by bond issues for work on realigning and controlling the Alamo Canal in Mexico, the District expended a considerable amount from General Funds for this purpose.

Commencing about six miles downstream from Cudahy Check, a section of the Alamo Canal some three or four miles in length, known as Alamo Mocho, gave particular trouble. Bed silt depositing in this section caused a continuous rise of the bottom of the Canal and hence of the water surface, requiring raising of the canal banks. This rise in water surface averaged between one-half and one foot per year.

It was also noted that, year by year, the bed silt was gradually moving farther into the main canals and laterals in the Imperial Valley, necessitating more dredging and, hence, increasing the cost of maintenance to the District. Sluicing of the canals into the Alamo and New Rivers was of benefit in removing bed silt, but still large amounts of this type and most of the suspended silt were carried through to the farms, causing added expense to the water users too.

Silt Problem

As an illustration of the seriousness of the silt problem to the Imperial Valley, conditions in the year 1923 are cited.

From tests made during that year, it was determined that about 25,000 acre-feet of silt passed through Rockwood Heading into the Alamo Canal; this equals 40,000,000 cubic yards but did not include all of the bedload or sand which was carried along the bottom of the canal and out of reach of the silt-sampling apparatus. Of this total quantity of silt, it was estimated, in round figures that 1,000,000 cubic yards was removed from the intake canal by suction dredging; 3,000,000 cubic yards was excavated in cleaning, by various methods, the remainder of the canal system; 10,500 cubic yards were disposed of by sluicing the canals and laterals; and deliveries of water to lands in Mexico carried 5,500,000 cubic yards onto those lands. The total of the foregoing amounts is 20,000,00 cubic yards, or one-half of the total of 40,000,000 cubic yards. This means that the other half, or at least 20,000,000 cubic yards of silt, was carried onto the irrigated lands in Imperial Valley.

The depositing of silt year by year on the farmlands not only threw them out of level, making frequent releveling necessary at considerable cost, but also caused difficulty in the growing of various types of crops. Also, as the silt raised the farmland, the District had to raise its canals and structures in order to be able to continue delivery of water to the land.

The large silt content of the water was also a source of difficulty and expense to the cities and towns of the Valley in preparing the water for their purposes. Likewise, it caused considerable inconvenience to the farmers in their domestic water supply.

These are but a few of the problems and costs created by silt with which the Valley had to contend.

Summary as of 1930

As of 1930, the District was operating some 1,700 miles of irrigation canals and laterals, 740 miles of lateral drains, and 234 miles of deep drain outlets, exclusive of Alamo and New Rivers, all in Imperial Valley. In lower California, the District, through its subsidiary company, was operating and maitaining some 130 miles of main canals and 74.5 miles of protective levees, 45.5 miles of which were equipped with a standard-gage railroad, along the Colorado River.

In Imperial Valley, the service area under the District's canal system as of 1930 was about 550,000 acres, with water being delivered to over 400,000 acres in crop, as well as to all of the cities and towns of the Valley. Agricultural production in Imperial Valley, which was nothing in 1900, had increased to $41,500,000 in 1929 but had dropped off to $35,000,000 in 1930, reflecting lower prices occasioned by the start of the depression. The population of the Valley had grown from nothing in 1900 to about 57,000 in 1930. In addition, construction of Hoover Dam and the All-American Canal were assured.

Considering all of the difficulties which had had to be contended with - physical, financial, and political - it was truly a remarkable development that had taken place in the short period of thirty years.

X. THE DEPRESSION YEARS

Financial Difficulties

The effect of the nationwide depression, which started with the crash of the stock market in the latter part of 1929, was felt somewhat in Imperial Valley during 1930 and increasingly so in the early part of 1931. However, after the middle of the latter year, it struck with full force and, with the continued drop in market prices for farm products and the drying up of credit sources, created one of the most difficult financial periods experienced in the history of the Valley. The effect of the depression is shown by the value of the agricultural production in the Valley, which had been in excess of $40,000,000 annually for the years 1928 and 1929 but which decreased to $27,000,000 in 1931 and to $19,000,000 in 1932.

Decrease in Assessment Collections

Revenue to the District, except from sales of water in Mexico, remained about normal until the fall of 1931, when there was a very sharp decline in the December assessment collections. The District had abolished water tolls in Imperial Valley in 1925 and since then had relied almost entirely upon revenue from assessments upon the land, and from sales of water in Mexico. Hence the decrease in assessment collections in December 1931, brought almost immediate financial stress to the District.

Decrease in Revenue from Mexico

In January, 1931, the Mexican Government arbitrarily made a 30 percent cut in the rate for sale of water to users in Mexico, from $1.40 (pesos) per 1,000 cubic meters to $1.00 (pesos), the American equivalent being from 86 cents per acre-foot to 62 cents. The reduction was to be for one year only, with provision for the District's Mexican Company to recover resulting losses in succeeding years.

However, in December, 1931, without previous notice, a second order was issued by the Government reducing the rate an additional 25 percent. On protest of the Mexican Company, an amended order was secured by which the second reduction was rescinded, but with the provision that the first reduction of 30 percent was to remain in effect indefinitely instead of for one year, the reason given by the Mexican Government being economic conditions in Mexico.

In July, 1931, Mexico went off the gold standard, causing additional loss to the District in exchange of currency. The combination of this and the reduction in water rate, together with a decrease in the cropped area, resulted in revenues from water sales in Mexico dropping from an average for the previous eight years of over $550,000 to approximately $199,000 in the year 1931 and to $86,000 in 1932.

Registered Warrants

From the time the District acquired the C. D. Company in 1916, it had been the general practice to finance current operations between assessment-paying periods (December and June) by registering warrants when presented for payment,

these being held by the banks until the District had funds available to redeem them. In fact, there had been only two years in the period 1916-1931 in which the District did not at some time have such warrants outstanding.

This policy was approved by the banks and had not been questioned prior to 1931. The warrants drew interest at 7 percent per annum, while farm loans and mortgages during that period carried interest rates of from 10 to 14 percent plus costs. (The Federal Land Bank had made a few farm loans about 1918 but had refused to make any more, basing its action on the flood hazard to Imperial Valley, international complications of water supply, etc...) In other words, the District could secure financing for its warrants at a lower rate of interest than could its farmers to pay an increase in water assessments.

The situation was under control until the depression hit the Valley in the latter part of 1931, at which time the banks demanded that the amount of outstanding registered warrants be reduced to not exceed $575,000 at any time. The total of such warrants, at the time, was about $775,000. The District made plans to comply with this demand, but the sharp increase in delinquent assessments in December, 1931, together with loss in revenue from sales of water in Mexico, made it impossible to do so. This is understandable when it is noted that total annual District revenues had decreased, in round figures, from $3,500,000 in 1929 to $2,475,000 in 1931.

In January, 1932, shortly after the District had applied all current assessment payments to the reduction of the outstanding registered warrants thereby reducing the total to about $650,000, the banks notified the District that they would accept no more such warrants. As a result, the District found itself without cash to cover even its current pay roll.

To meet this situation, pay roll checks for each employee issued after January 15, 1932, were split into denominations of $5, $10, and $20, which the merchants would accept, enabling the employee to keep up with his current expenses. Warrants issued by the District for other current operating expenses had to be held, for the time being, by those to whom they were issued. Under date of January 26, 1932, the Board of Directors authorized the issuance of warrants in exchange for pay roll checks to enable the holders to receive interest.

Another step taken by the Board of Directors to meet the crisis was to re-establish a toll charge of 50 cents per acre-foot on water deliveries, to become effective March 15, 1932.

On March 19, the banks again agreed to cash current pay roll checks, and warrants issued for minimum District operations. They also agreed to cash one-half of each outstanding registered warrant; to facilitate this, the District issued two warrants to each holder of a warrant, one of which he was able to cash at the bank. By this time, the total amount of outstanding registered warrants had increased to $845,000.

On April, 19, the banks again shut off all credit to the District, but by this time some revenue was being received from the water toll established on March 15. With this revenue and that from sales of water in Mexico and other miscellaneous sources, and with the co-operation of suppliers who would accept and hold warrants, the District was able to meet its current expenses

and gradually better its financial condition. By the end of 1932, the outstanding registered warrants totalled $885,000, but the District was on a cash basis to meet its current operating expenditures and has maintained that position ever since.

Retrenchment Program

In anticipation of the effects of the depression, the District had instituted a program of retrenchment in 1930. The program was intensified, particularly in the latter part of 1931 and in 1932. Wages and salaries were reduced and there was a sharp curtailment in maintenance work on the canal system, with expenditures for additions and betterments being practically eliminated. As a result of this program, total expenditures in 1932, other than for fixed charges, were reduced nearly 50 percent below normal.

The postponement of work which should have been done was not an economy, it being realized that it would no doubt cost more to catch up on the delayed work in later years, but it was a desperate effort to meet the financial crisis which the District faced. At the time it was felt that the depression, although severe, would be of short duration, and with the return of normal conditions, the delayed work could be accomplished - this did not prove to be true.

By Board action, the assessment rate, which had been $5.00 for each $100 of assessed valuation for a number of years, was reduced to $1.50 for the year 1933. It was believed, after full consideration of conditions, that this rate, together with the water toll, was the maximum which the landowners could pay, in view of the extreme depth of the depression. Even with this low assessment rate, delinquency in the payment of the assessments for 1933 amounted to over 45 percent.

Refinancing

First Refunding Plan

During the seventeen years, from the first issue of District bonds in 1915 up to and including January 1, 1932, principal and interest payments on all outstanding issues had been promptly made when due. The four original issues of bonds totalled the principal amount of $16,000,000. Redemption had commenced in 1925, and to and including January 1, 1932, $1,750,000 of principal amount had been retired, reducing the outstanding unmatured bonds to $14,250,000.

In view of the large decrease in revenue, it is not surprising that there was a default in payments due July 1, 1932 - the first of record. Of the total of $700,000 for principal and interest payable on that date, there was a default in the payment of $68,000 of principal and approximately $148,000 of interest. It was apparent that the default would continue on succeeding payments coming due and that something had to be done to meet the situation.

A committee representing a majority of the outstanding bonds was organized and meetings were held with District officials to work out a plan. It was the opinion held by both the District and the bondholders that while relief would have to be granted, such would be only temporary, that the depression would not last long, and with the return to normal conditions the District could carry on according to schedule.

A refunding plan was worked out and agreed to which provided that the original serial bonds be exchanged, par for par, for a new "First Refunding Issue" of sinking fund bonds, the new bonds to be callable on any interest payment date. Maturities of the 5 percent and 6 percent bonds were extended to January 1, 1983, and maturities of the 5½ percent bonds were extended to July 1, 1939, and July 1, 1942. Interest rates on all original bonds and outstanding warrants were reduced by approximately 50 percent on the average, from 1933 to 1936, at which latter time the full interest rates would again apply. An annual sinking fund was to be started in 1938, which would mature all bonds on or before date of maturity.

It was also a condition of the Plan that prior to its confirmation, arrangements satisfactory to the committee were to be made between the District and the warrant holders for retirement of the outstanding warrant indebtedness, which totalled approximately $885,000. The Plan further provided for the creation of a Contingent Fund for the period ending January 1, 1938, in which would be deposited all sums received by the District from the payment of delinquent assessments, including redemption of lands sold for nonpayment of assessments, together with interest, penalties, and costs. The purpose of the Fund was to pay the amount of the defaulted interest and principal of July 1, 1932, interest due January 1 and July 1, 1933, and interest on the registered warrants for the corresponding dates.

The Plan was approved by a vote of the people on January 12, 1933, and the refunding bonds were dated February 1, 1933. Approximately 94 percent of the outstanding bonds eventually were deposited under the Plan.

Under date of June 8, 1934, the Board of Directors of the District approved a warrant retirement plan which provided for a reduction of approximately 50 percent in the interest rate for the period 1933-1936 with the full interest rate to be paid thereafter, the gradual retirement of the warrants over a period of years, and requirements as set forth in the Bond Refunding Plan. The warrant Plan was accepted by practically all of the holders of the outstanding registered warrants.

Effect of 1934 Water Shortage

In 1934, the year prior to commencement of storage behind Hoover Dam, and the last year in which it could occur, the most severe water shortage ever recorded on the Colorado River was had. The total flow of the River was less than half of the previous annual minimum. Although the District had rights senior to those of many of the upstream appropriators, it was the last diverter on the River and therefore got what was left.

The shortage lasted from May well into December of 1934, and at times there was hardly enough water to meet even domestic and stock needs. The crop losses ran into millions of dollars, and it was a very severe blow to the Valley, coming as it did on top of the depression, which was still in progress.

The financial losses to the farmers were mitigated to some extent by arrangements being made to construct several miles of the All-American Canal lying to the north of Calexico by use of local team equipment, but the returns from this work were, of course, small compared to the crop losses.

Because of the tremendous losses from the water shortage, together with the continuing depression, and also because the time had come when much of the postponed maintenance work on the canal and drainage systems had to be performed and the drainage system extended, it was obvious that the relief granted by the first Refunding Plan would have to be supplemented, in the best interests of the bond and warrant holders as well as the District and its people.

Application to Reconstruction Finance Corporation

Therefore, negotiations were resumed with the bondholders committee, and it was agreed that the District should endeavor to secure a loan from the Reconstruction Finance Corporation for the refinancing of the bonds and warrants and for drainage construction.

In May, 1935, the District applied to RFC for such a loan. RFC agreed to make a loan to the District sufficient to pay the bondholders, in cash, $750 for each $1,000 bond and, in addition, provide $1,950,000 for drainage construction; but refunding on this basis was refused by the bondholders.

Litigation

Amendments to the National Bankruptcy Act making it applicable to public debt became effective on May 25, 1934. In September of that year, the District filed a petition in the United States District Court, under the terms of the Act, requesting approval of the first Refunding Plan in order to force the nonconsenting bondholders to accept the refunding program. The Court approved the petition under date of May 5, 1935, but the nonconsenting bondholders appealed the decision to the Federal Courts. In the meantime, the exchange of the bonds and deposit of the warrants were proceeding under the Plan, but when only partially completed, the United States Supreme Court, in a similar case, held the provisions of the 1934 Act to be null and void. Following this decision, the United States Circuit Court ordered the District Court to dismiss the District's petition, which the latter Court did in February, 1937.

Later in 1937, the nonconsenting bondholders brought actions in the State Courts seeking to force payment in full, by Imperial Irrigation District, of the matured bonds and interest coupons which they held, including interest at 7 percent from the respective dates of maturity. In December, 1937, the nonconsenting bondholders also filed a petition in the United States District Court for a writ of mandate to compel the District to levy against the lands of the District a sum sufficient to pay all of the matured bonds and interest coupons and to pay in full all of the registered warrants, including those which had been deposited as well as those which had not been deposited under the Refunding Plan. The District Court refused to grant the petition.

By reason of all of this litigation, interest due on the refunding bonds and warrants, which had been paid in accordance with the Refunding Plan until January 1, 1937, was not paid on that date, as the interest monies available had been impounded by Court Order pending a settlement of the conflicting claims of the bondholders. In August, 1937, the District requested the Court to modify its order so as to release funds for payment of interest due on deposited bonds and warrants. This the Court did in November of that year to the extent of ordering payment of January 1, 1937, interest on both deposited and non-deposited bonds. Funds for the payment of interest due July 1, 1937, and

thereafter were impounded by the Court Order pending a final determination of the litigation.

Second Application to Reconstruction Finance Corporation

In a further effort to secure the relief required by the District as well as funds for drainage construction, the District, in March, 1938, made a new application to RFC for a loan to purchase 75 percent of the outstanding bonds and warrants at 75 cents on the dollar, with the remaining 25 percent of the bonds and warrants to be exchanged par for par for new bonds. Both the RFC loan and the new bonds would carry a 4 percent interest rate. The application also included a loan of $1,000,000 for drainage construction.

While it appeared that this plan would have been acceptable to a majority of the bond and warrant holders, approval was refused by RFC. In subsequent negotiations, no plan could be found which was acceptable to both RFC and the bond and warrant holders.

Plan of Composition - 1939

Following failure to refinance through the Reconstruction Finance Corporation, negotiations were continued between the District and the bond and warrant holders in an effort to work out a plan which would give the District the relief it had to have and still be acceptable to the bond and warrant holders. An agreement was reached toward the end of 1938 and was adopted by the District in a resolution of its Board of Directors dated February 7, 1939.

By this time, the Congress had amended Section 80 of Chapter IX of the National Bankruptcy Act, and it was felt that, as amended, the objections which had been previously raised by the Supreme Court would be met and the legality of the Act upheld.

Under the new agreement, the First Refunding Plan of 1932 and the Warrant Retirement Plan were modified and, as modified, constituted a Plan of Composition within the meaning of Chapter IX of the National Bankruptcy Act as amended.

The Plan of Composition was to be dated January 1, 1939. It made no reduction in the principal of either the bonds or the warrants. However, the interest rate on the outstanding 6 percent bonds was reduced by endorsement to 4½ percent, and on the outstanding 5 percent bonds to 3 3/4 percent. The interest rate on the 5½ percent bonds due in 1939 and 1943 was reduced to 4 1/8 percent and maturities extended to 1964. The interest rate on warrants was reduced from 7 percent to 5¼ percent.

The plan also provided that, in view of this reduction in interest rates, there would be established a Drainage Fund, for which the District would provide $150,000 per annum. The District would also establish an Emergency Fund, for which it would provide $50,000 per annum. The annual levies for both the Drainage Fund and the Emergency Fund were to be included as a part of the total assessment rate for each year. If after February 1, 1944, there should be accumulated in the Drainage Fund a sum totalling $300,000 in excess of the current drainage work, the surplus would have to be deposited in the Redemption Fund, which is described later. In the same manner, if at any time the monies in the Emergency Fund should exceed $150,000, the amount of such excess would also have to be deposited in the Redemption Fund.

The Plan further provided that past-due interest be paid at the full rate for July 1, 1937, and January 1, 1938, and at 75 percent of full value for January 1, 1939, and subsequently. It also provided for waiver by the bondholders and warrant holders of all interest due July 1, 1938, and 25 percent of that due January 1, 1939, with the amount of waived interest, totalling approximately $400,000, to be placed in the Drainage Fund.

Under the provisions of the plan, the District agreed to levy a minimum debt-service assessment each year of $725,000, the assessment rate to be determined after deducting 15 percent from the assessed value of the lands, as provided in the Irrigation District Act, as an allowance for delinquencies in the payment of assessments. Any deficiency in collecting the full amount of $725,000 in any year was to be made up by additional levies in subsequent years, but in no event was the District to be obligated to make a net levy in any year for debt service exceeding $797,500.

Monies received from each annual debt-service assessment were to be placed in a Redemption Fund which was to be used to pay each year, first, interest due on the bonds and warrants, and the remainder to be deposited in a Sinking Fund. The Sinking Fund was to be applied one-half to the call and redemption of bonds and the remaining one-half to the retirement of all warrants, all monies in the Sinking Fund were to be applied to the call and redemption of bonds.

The Plan of Composition was approved at a District election held on March 22, 1939. It was declared in effect by resolution of the District Board of Directors in December, 1940, and payments made accordingly, including those to the Drainage Fund to permit drainage construction work to progress. The Board also levied assessments in accordance with the terms of the Plan.

Litigation

Shortly after the election referred to of March, 1939, the District filed a petition in the Federal District Court, under the amended National Bankruptcy Act, requesting approval of the Plan of Composition and the release of impounded past-due interest monies, but it was not until February 24, 1941, that the Court confirmed the Plan.

The long delay by the Court in reaching its decision was due to its expressed desire to await decisions of the higher Courts with respect to the refunding plans of several other California irrigation districts. These other refunding plans were approved by the Federal District Courts, the decisions being upheld by the Circuit Court of Appeals and, later by the United States Supreme Court when, on January 6, 1941, that Court denied petitions for review by the dissenting bondholders in two cases and on February 17, 1931, took similar action with regard to three other cases.

The dissenting bondholders, despite the ruling of the Supreme Court in the other cases, carried the decision in the Imperial case to the Court of Appeals, which, by decision of April 29, 1943, upheld the previous decision of the District Court donfirming the Plan. All but $245,000 (or 1 3/4 percent) of the outstanding warrants accepted the Plan of Composition.

Other Events to 1940

Improved Situation

With the Plan of Composition becoming effective, the District's financial position very greatly improved. However, it had been a most difficult decade through which the District and its people had had to operate; but on the bright side, several events had taken place which offered much encouragement.

During the period prior to storage in Lake Mead in 1935, there had been no large river floods; hence expenditures required for flood protection were at a minimum. The silt content of the water, which had been excessive for several years prior to 1931, greatly increasing the cost of canal maintenance, had returned to normal, which assisted in carrying out the retrenchment program.

As had been anticipated, this very severe retrenchment program in the early thirties resulted in a deterioration of the canal and drainage systems, but toward the latter part of the period it was possible to catch up on a considerable part of the delayed work. Also, with the monies made available to the Drainage Fund under the Plan of Composition, drainage construction was going forward at a much increased pace. Moreover, after 1932 the District issued no more registered warrants and had maintained its cash position for current expenditures.

Commencing on February 1, 1935, storage of water in Lake Mead behind Hoover Dam had begun, which removed the major flood danger and assured an ample water supply for the Valley. Construction of the All-American Canal had started in 1934, the head works had been dedicated in 1938, and service to the Valley was to be commenced in a short time. The Canal not only would eliminate the international difficulties and diversion problems which had previously existed, but, together with Hoover Dam, would in time largely eliminate the silt problem. In May, 1936, the District's power system had gone into operation and was rapidly being expanded to cover the entire Valley. Revenue from power sales was increasing rapidly, and an additional source of power would soon be available from plants then under construction by the District on the All-American Canal. Lastly, to all of the foregoing should be added the effect from the rapidly improving market for agricultural products, both as to prices and demand, which had developed in the latter part of the period.

1939 Storm

But mention should be made of two serious events which the District had to meet, one of which occurred in 1939 and the other in 1940.

In September, 1939, a storm resulting from a hurricane off the west coast of Mexico swept up through the trough of the Colorado River Valley, and during one week in which rain fell in Imperial Valley almost continuously, there was nearly 7 inches of precipitation - not only the maximum amount for any one storm but more than the total amount for any one year, in the history of the Valley.

Great damage was done to both the canal and drainage systems. The West Side Main Canal and the north end of the East Highline Canal were broken in many places and canal banks were seriously damaged over a length of many miles.

A large number of lateral headings and drop and delivery structures were destroyed, as well as a number of miles of lateral canal banks. Several major drainage structures were washed out, and other serious damage to the drainage system occurred at many points.

The cost of repairing the damage to the canal and drainage systems amounted to about $110,000. A part of this cost was met with funds from the newly created Emergency Fund provided for by the 1939 Plan of Composition and the balance from the General Fund.

1940 Earthquake

The second disastrous event was the earthquake of May 18, 1940 - the most severe since the development of the Valley commenced. It was caused by a movement of the San Jacinto fault, which passes through the Valley, from the northwest to the southeast, a few miles to the west of Brawley and several miles to the east of El Centro and Calexico. The epicenter was located approximately on the international boundary line, and it was possible to trace the fault for a distance of some forty to fifty miles, commencing in Mexico near Volcano Lake and extending through Lower California and on through Imperial Valley to north of Brawley. The maximum slippage was over 14 feet near the international boundary line.

The principal damage occurred to the canal system in Mexico. For several miles below Tortuoso Drop the Solfatara Canal was completely destroyed. The large flume carrying the West Side Main over New River was completely wrecked and large longitudinal cracks were opened up in many miles of the Alamo and other canals.

In Imperial Valley, the East Highline Canal was cracked in many places, and the Ash Canal and its laterals were severely damaged. Along the fault itself, the shift caused an offset in the canals it crossed, and in several cases structures were destroyed.

The earthquake also caused very extensive damage in most of the cities and towns of the Valley, and several people lost their lives. The remarkable thing is that great numbers were not killed or severely injured.

The entire water supply to the District's canal system had to be cut off for several days until repairs were completed and service re-established to most of the canal system. With the loss of the Solfatara Canal and the New River Flume in Lower California, the entire water supply for the west side of Imperial Valley was cut off. However, the All-American Canal had been completed from the Central Main Canal east of Calexico to the West Side Main Canal and, with water from the Central Main Canal, was put into service to supply the west side of the Valley. Had this not been available, there would have been considerable loss of crops in that area.

The Solfatara Canal was rebuilt and, together with the partial use of the All-American Canal, supplied the west side of the Valley until the balance of the All-American Canal was completed and put into service. As it was known that water would soon be available through the All-American Canal, the New River Flume in Lower California was not rebuilt.

The total cost of repairing the damage to the District's canal and drainage systems caused by the 1940 earthquake amounted to approximately $265,000. Of this amount, the State of California contributed $75,000 and the United States granted a deferment in the current annual payment of $86,000 on the Laguna Dam contract, which amount was also used to offset the cost of repairs.

XI. THE ALL-AMERICAN CANAL

Background of Canal

Topographic Conditions

As heretofore explained, the delta of the Colorado River spreads out below Yuma, south to the Gulf of California and to the west through Lower California, Mexico, and north into Imperial Valley and the Salton Sink. The central portion of Imperial Valley, which is a part of the delta, is flanked on either side by a mesa. That on the west extends southerly into Lower California and thence easterly to Cierro Preito. The East Mesa of Imperial Valley extends into Lower California for several miles, where it merges with the delta of the River. Along the easterly side of the East Mesa between Imperial Valley and the River is a large range of sand hills extending in a northwesterly-southeasterly direction for some forty miles, the southerly end of which is a few miles south of the international boundary line. Along the boundary line, this range of sand hills is some seven or eight miles in width and presented a formidable barrier to the construction of a canal through them.

It was very early recognized that the delta portion of Imperial Valley could be covered by gravity flow by following a natural route from the Colorado River near the boundary line, through Mexico, as by this means overflow from the River had reached Salton Sink in the past. But to irrigate the maximum possible acreage by gravity in Imperial Valley meant going up the River above the boundary for a number of miles, to secure an elevation high enough to cover the mesas. Conditions were such that a point known as the Potholes, some twenty-five miles above the boundary, was suitable for locating the diversion, and the elevation was such that the major portion of the East Mesa could be reached by gravity. It was known that such an elevation would also cover a large part of Coachella Valley and the West Mesa by gravity.

A canal diverting from this higher elevation up the River could be located entirely on the United States side of the Boundary line and thus would not involve Mexico in the development of Imperial Valley - hence the name All-American Canal - but this would mean either cutting through or tunneling under the range of sand hills.

Early Plans

While the development envisaged by Wozencraft in the 1850's included all of Imperial and Coachella Valleys, his engineer, Hadley, recommended following a route through Mexico from a diversion point at the international boundary which would have covered all the delta portion of the Imperial Valley. To have also served the mesas and Coachella Valley would have meant a considerable pump lift.

Rockwood's original plan also envisaged development of a maximum acreage by gravity in Imperial Valley, and his canal would have diverted from the River at the Potholes. However, it would not have been an All-American canal, as he located it in Mexico to get around the south end of the range of sand hills. He had to abandon this plan as it was too costly to finance and change the diversion point to the international boundary line at Hanlon, from where he followed the natural route through Lower California, leaving the high-

er diversion plan for a later development.

It must be recognized that in those early times, while the maximum development of the Colorado River Desert in the United States was desired, the question of financing was more important. Apparently not much consideration was given to possible future international complications which might result from a canal passing through Lower California, Mexico, into Imperial Valley; in fact, it was not for a number of years that the vital necessity for an all-American canal was realized. Neither did the early planners appreciate the difficulties which were to occur with a diversion at or below the international boundary line; first-cost naturally had to be the major consideration.

Early Government Proposals

In its first investigations of the possibility of reclaiming lands in California with water from the Colorado River, the U. S. Government considered an All-American Canal. As previously described, the Fourth Annual Report of the U. S. Reclamation Service in 1904-05 included a map showing a proposed All-American Canal from Laguna Dam to Imperial Valley, including a long tunnel starting north of Pilot Knob and extending westerly under the sand dunes a distance of some 15½ miles. Since the estimated cost of the tunnel alone was reported to be $20,000,000, a canal on this location would have been financially infeasible. In this connection, the U. S. Geological Survey in 1902-04, in connection with its plans for the Yuma Project on the California side of the River, extended its topographic survey to the international boundary and thence westerly for about two miles, covering a strip along the boundary about 500 feet in width.

Under date of January 12, 1907, President Roosevelt sent a Special Message to the Congress dealing with problems on the Lower Colorado River, which Message has been previously mentioned. Among others, his Message included the recommendations that the United States acquire the properties of the California Development Company, construct an All-American Canal, and develop Imperial Valley. He said, in this connection, that: "The construction work required would be: The main canal, some 60 miles in length, from Laguna Dam into the Imperial Valley; the repair and partial reconstruction of the present distribution system in the valley and its extension to other lands, mainly public; diversion dams and distribution systems in the Colorado River Valley, and provision for supplementing the natural flow of the river by means of such storage reservoirs as may be necessary."

In further contemplation of an All-American Canal, the Reclamation Service in 1908 made a topographic survey of the East Mesa as far north as the main line of the Southern Pacific railroad. Also, some preliminary lines were surveyed for a high-line canal which would skirt the south end of the range of sand hills through Lower Calfiornia, no doubt to compare the cost of such a location with that for a canal cut through the sand dunes in the United States.

District Survey of 1913

By the time Imperial Irrigation District was organized in 1911, there was a growing realization among leaders in Imperial Valley of the need for an All-American Canal. Although the District did not acquire the properties of the C. D. Company until 1916, as early as 1913 it made a survey for an All-American Canal from Laguna Dam to the East Highline Canal. The location of the canal from opposite Hanlon Heading west to the East Highline Canal followed along and parallel

with the international boundary.

In connection with the location of the canal and the feasibility and relative cost of a tunnel under the sand hills or an open cut, P. N. Nunn reported to the Board of Directors of the District by letter dated July 16, 1913. He pointed out that a 15½ mile tunnel, as had been proposed by the Reclamation Service, at an estimated cost of $20,000,000 was feasible, but a change in the location of the canal could shorten the tunnel to a length of about eight miles, with the cost reduced to $11,000,000. However, he stated that the cost of an open cut through the sand hills would be only a fraction of the cost of the tunnel and would be entirely feasible. His report also included suggestions for keeping the channel clear of blowing sand should such be necessary. He also submitted as his estimate of the cost of the entire canal, including the construction of two power plants, the sum of $12,000,000. He did not include in his estimate the cost of canal structures other than the power plants nor any allowance for securing to the District the right to divert its water at Laguna Dam. Although the practicability of constructing and maintaining an open cut through the sand hills was one of the major questions raised by opponents of an All-American Canal, experience has shown that Mr. Nunn was correct in his opinion that such an open cut was feasible.

From this time on, the matter of an All-American Canal became a subject of increasing discussions throughout Imperial Valley. Some favored the building of only the "first leg" of the canal from Laguna Dam and Hanlon and there connect it with the existing Alamo Canal. They questioned whether the District could repay the cost of the canal.

In December of 1914, representatives of the District were sent to Washington, D. C. to discuss with the Secretary of the Interior the possibility of the District's securing the right to divert its water at Laguna Dam. This was the commencement of negotiations leading up to what became known as the Laguna Dam contract of 1918, which will be discussed subsequently.

Imperial Laguna Water Company

In 1914, a group composed mainly of Imperial Valley farmers organized a mutual water company known as Imperial Laguna Water Company, for the purpose of developing the lands on the East Mesa of Imperial Valley. The plan was to build a canal from Laguna Dam to the East Mesa and a distribution system to irrigate about 200,000 acres of land. Except for two school sections in each township, all of the area on the East Mesa was public lands of the United States which had been withdrawn from entry at an early date. The Company planned to finance the project in a way similar to that utilized in the original development of the Imperial Valley; that is, with funds secured from the sale of water stock, the canal system would be constructed. The owners of the water stock would locate it on the public lands which were to be opened for entry by the Government.

The financing for investigations, surveys, etc..., was accomplished through the sale of some 10,000 shares of water stock to sixty-five individuals at an average price of $7.50 per share.

The Company made preliminary surveys for the main canal from Laguna Dam to the East Mesa and negotiated with the Secretary of the Interior for the right

to get its water from Laguna Dam and for the opening of the lands to entry.

These negotiations resulted in a contract between the Government and the Company dated July 6, 1917, under the Act of February 21, 1911, commonly known as the Warren Act (36 State., 295), which authorized the Secretary of the Interior to cooperate with organizations in the construction and use of reclamation facilities for the irrigation of public and private lands.

Among the more important provisions of the contract were the following:

1. The Company was to proceed with diligence to make a complete detailed survey, specifications and estimates of cost of all necessary works for (a) a canal from Laguna Dam to the East Mesa with sufficient capacity to serve that area; (b) such power development or pumping operations under contemplation in connection with the irrigation system; and (c) preliminary plans and estimates of cost for a distribution canal system.

2. The surveys, plans and estimates of cost were to be completed and a full report made to the Secretary of the Interior within six months from date of the contract.

3. That as to such report, the Secretary of the Interior, after full consideration of it, would (a) require further or additional surveys, specifications and estimate of cost to assure the feasibility of the project; (b) reject the report in its entirety, in which case the contract would become void; or (c) accept the report in its entirety, in which event the Company would proceed to construct the necessary works in accordance with the terms and conditions of the contract.

4. For the right to utilize Laguna Dam and the section of the Yuma Canal down to Siphon Drop, the Company was to pay the sum of $960,000, of which $200,000 was to be a down payment and the balance of $760,000 paid in six equal installments.

Other provisions of the contract dealt with the sale of water stock by the Company, the opening of lands to entry by the Secretary, and protection for the prior rights to the use of water of other projects.

As required by the contract, the Imperial Laguna Water Company proceeded with surveys, plans and estimates of cost, submitting the required report to the Secretary of the Interior under date of January 30, 1918.

The Secretary of the Interior acknowledged receipt of the report by letter to the Imperial Laguna Water Company dated April 16, 1918, stating that the data furnished was not sufficient to fulfill the requirements of the contract and the report could not be approved at that time.

In his letter, the Secretary also referred to the fact that "there have been extensive negotiations and conferences" with representatives of Imperial Irrigation District relative to a connection with Laguna Dam and the construction of an All-American Canal. The letter further stated that to that end a "tentative contract (Laguna Dam Contract subsequently approved in October, 1918) had been drafted and submitted to the District that it was apparent the construction and operation under both contracts could not proceed independently; and that the representatives of the District had stated repeatedly the District was

favorably disposed toward inclusion of the mesa lands in the District". The letter went on to say that in view of all of these conditions, action under the contract with the Company of July 6, 1917 would be suspended "for the present" and that this "will afford to the Company and the people of the Imperial Irrigation District an opportunity to consider further the advisability and ways and means of bringing in the mesa lands".

In view of the fact that Imperial Irrigation District had under consideration a connection with Laguna Dam and the construction of an All-American Canal, the location of which would be the same as that for a canal to irrigate only the East Mesa, the plans of the Imperial Laguna Water Company received widespread discussion by the people of Imperial Valley and there were many negotiations between the Company and the District to work out a plan of cooperation between the two organizations.

Under date of April 14, 1916, the Company submitted a proposal to the District providing that the former would build an All-American Canal with capacity to serve the District and deliver water at the East Highline Canal for 25 cents an acre-foot. Also, that the Company would recognize a prior right of the District to 2,400,000 acre-feet of water per year. On the same date, the District Board received the proposal and placed it on file, one Director being appointed as a committee to confer with the Company for the purpose of formulating a contract or resolution to be presented to the Board for consideration. However, no concrete proposal developed from this action.

By letter dated November 6, 1916 and signed by the officers of the Company, another proposal was submitted to the District. The letter pointed out that the Company recognized the validity of the District's water rights; that the Board of Engineers appointed by the District had recommended the installation of a new overpour gate above the then existing Hanlon Heading to be able to divert sufficient water for Imperial Valley, which might obviate the necessity of the District's making a connection with Laguna Dam (the report of this Board which has been previously discussed, resulted in the construction of Rockwood Heading); and that the development of the East Mesa would increase the tax revenue of the County and be in the best interests of the entire Valley. At this time, which, it will be noted, was prior to the Company's contract of July 6, 1917, with the Secretary of the Interior, the Company was considering locating the high-line canal around the lower end of the sand hills in Mexico.

This is borne out by the proposal the Company submitted with this letter by which the Company asked the District to furnish right of way for the high-line canal through its Hanlon properties and around the sand hills in Mexico. In consideration for this right of way, the Company would deliver to the District's canal at Hanlon a continuous flow of 2,000 second-feet of water and would construct such sluiceways and settling basins as might be required to deliver this water free from heavy silt.

The letter and proposal of the Company were submitted by a committee from the Company to the District Board on November 8, 1916. The Board referred the matter to its attorney and to the Board of Consulting Engineers, with a request for a report. By letter dated December 19, 1916, the Consulting Engineers, C. E. Grunsky and George G. Anderson, reported adversely on the proposal. While the District could, if it so desired, grant the right of way through the Hanlon properties, under the agreement whereby the District purchased the C. D. Company and the two Mexican Companies from the Southern Pacific Company, the latter retain-

ed title to all lands in Mexico, in view of which the District could not grant the Imperial Laguna Water Company the right of way around the south end of the sand dunes. The Engineers further pointed out the possibility of the District's desiring to connect its canal system with Laguna Dam and the possible conflicts which might result if the Imperial Laguna Water Company proceeded with its plans.

This report of the Consulting Board of Engineers was received by the District Board on December 19, 1916 and ordered placed on file.

On December 23, 1916, the District Board of Directors adopted a resolution favoring early development of the East Mesa lands and offering to cooperate with the Imperial Laguna Water Company to that end, under such conditions, restrictions and limitations as might be required by the District's Engineering and Legal Departments to insure priorities of the District's water rights and to protect the District in every way against any added burdens or liabilities resulting therefrom either in the United States or Mexico and against any injury to or interference with the operation and maintenance of the District's irrigation system.

It will be noted that these proposals and resolutions were all prior to the Imperial Laguna Water Company's securing its contract with the United States of July 6, 1917, previously referred to, and it was during this time and the following year that the sentiment crystallized in Imperial Valley for the District to build an All-American Canal and to that end negotiations were carried on by the District and the Federal Government which culminated in the so-called Laguna Dam contract of October 23, 1918, hereinafter discussed.

Conditions Requiring an All-American Canal

There were a number of conditions which influenced the sentiment of the people of Imperial Valley as to the vital necessity for an All-American Canal. Reference has already been made to the difficulties which had been encountered over the years with diversions from the River at Hanlon Heading. These were complicated by the necessity for a temporary diversion weir in the River and resulted in the injunction secured in 1916, by the Yuma County Water Users' Association. Furthermore, a permit had to be secured each year from the War Department before the weir could be built, and that Department indicated that sooner or later another diversion point further up the River would have to be secured.

Although it was anticipated that the building of Rockwood Heading in 1917-1918 might improve conditions to the extent that the weir would not be necessary, such was not the case, and a short time later, as has been previously mentioned, the contract with the Yuma Water Users' Association for the temporary weir required the District to secure another point of diversion at the earliest possible date. This same requirement was also included in the annual permits for the temporary weir secured from the War Department.

Another condition was that of foreign control of the water supply of Imperial Valley. While the water was diverted from the River at Hanlon Heading in the United States, the canal immediately passed into Mexico, where the jurisdiction and control passed into the hands of the Mexican Government, as of course it had to. Then the water was carried through Lower California by a Mexican company and delivered back to the Disrict at the international boundary. In this connection, it should be remembered that this control applied to the water supply not only for the irrigation needs of Imperial Valley, but for all domestic and industrial uses, both in the cities and towns and on the farms, as well.

Under the concession of 1904, Mexico had the right to one-half of the water flowing through the canals in Lower California, which, in effect, represented a loss of that much water to the supply available for Imperial Valley - by an All-American Canal this loss could be recovered and made available for expansion of the development of the Valley.

Also, there was the legal question of the right of the District to own the Mexican Company, which was subject to question being raised by the Mexican Government at any time, and an adverse decision would have meant the nullification of the concession by which the water supply for Imperial Valley was permitted to pass through Lower California.

In connection with the delivery of water to lands in Lower California, the rate charged was fixed by the Mexican Government, over which, of course, the District had no control, and the District's books reflected a considerable cost to Imperial Valley by reason of the fact that the Mexican lands did not pay their share of the costs.

Another factor was the increasing difficulty and cost occasioned by the gradual extension of the effect of the heavy bed silt throughout the canal system in Imperial Valley. Of course, a connection of the District's canal system to Laguna Dam would have improved this situaion, but there was considerable question whether the United States Government would have permitted such a connection under the conditions of the 1904 concession requiring that half of the water be delivered to lands in Lower California.

Moreover, as has been hereinabove referred to, the Federal Land Bank had refused to continue making farm loans in Imperial Valley, giving among its reasons that of the water supply coming through a foreign country and the uncertainty of the diversions at Hanlon.

Last but not least, the plans of the Imperial Laguna Water Company to build a high-line canal from Laguna Dam to the East Mesa indicated the necessity for the District's reaching a decision as to future plans if it intended to keep control of the water supply for Imperial Valley.

West Mesa and Coachella Valley

In addition to the proposal for developing the East Mesa, interests on the West Mesa and in Coachella Valley also came into the picture, looking for a water supply from the Colorado River.

On the West Mesa, there had been several thousand acres of public land homesteaded, while there was sufficient underground water to prove up on their properties and secure patent, it was not sufficient for their irrigation requirements and, moreover, was impaired as to quality. These people organized an association known as the West Side Imperial Irrigation Company and proposed to secure a water supply for 200,000 acres on the west side of Imperial Valley.

In Coachella Valley, about 8,000 acres of land had been developed by pumping from deep wells. However, this underground supply was very limited and the level in the wells was dropping year by year. Moreover, there was in the nieghborhood of 100,000 acres of additional land which could be developed, were a water supply available.

In view of this situation, leaders in that Valley joined with others on the plan for an All-American Canal with a branch which would reach Coachella Valley, and after passing around that Valley continue southerly to the lands on the West Mesa of Imperial Valley. To further this purpose, the Coachella Valley County Water District was organized January 16, 1918, under the County Water District Act of California, and became very active in connection with the All-American Canal Project.